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The effect concentration of butterfly pea extract (Clitoria ternatea L.) and addition of canna edulis flour (Canna edulis kerr) on the characteristics cream soup instant produce by rotary Dryer

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Abstract

The objective of this research is to determine the influence of butterfly pea extract concentration and the addition of canna flour on the characteristics of instant cream soup. The research design used a Randomized Block Design (RBD) with a 3x3 factorial pattern consisting of 2 factors with 2 replications, resulting in 18 experimental units. Factor T represents the concentration of butterfly pea flower extract, consisting of 3 levels: t1 (5%), t2 (10%), and t3 (15%), while factor G represents the addition of canna flour, consisting of 3 levels: g1 (10%), g2 (20%), and g3 (30%). The physical responses in this study include dissolution time, color intensity, and SEM (Scanning Electron Microscopy). Chemical responses include water content, ash content, protein content, fat content, carbohydrate content, and total anthocyanin. Organoleptic responses include hedonic tests for color, taste, aroma, and thickness.

Keywords: Butterfly pea, Canna edulis flour, Cream soup instant.

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1. Introduction

In today's modern society, there is a growing demand for instant food products. The food products sought by this modern community are not solely for satisfying hunger. The current need is for food products that offer health benefits, are practical, and quick to serve. Therefore, there is a necessity for foods that contain antioxidants and other nutritional values, expected to fulfill the increasing demands while considering health and convenience aspects, such as instant cream soup products.

The evolution of time has led society to demand everything to be fast and convenient, including adults who tend to favor instant food products. This usually refers to powder or dry-based products that can quickly dissolve when water is added, one example being instant cream soup. Generally, people consume instant cream soup for breakfast, as the advantage of this instant soup product lies in its ready-to-cook and ready-to-eat nature.

Soup is classified into two main groups: clear soup (thin soup) and thick soup (thick soup). Clear soup is made from a base of clear broth, served either plain or garnished with other food ingredients, while thick soup is prepared using thickening agents, which may include ingredients containing starch; one example being cream soup [1].

Until now, the cream soups available in the market have not shown much variation in their appearance. The typical appearance of cream soup is often associated with a white or grayish color. The visual aspect of food color plays a significant role in the selection of a food product. There is a need for innovation to create an appealing color presentation that can enhance public acceptance. Introducing an innovative cream soup product that utilizes the butterfly pea flower as a coloring agent holds high potential. This research aims to provide information on the diversification of cream soup products based on the butterfly pea flower. Through this food innovation, the butterfly pea flower can be utilized as the main ingredient, thereby increasing its economic value.

Traditionally, butterfly pea flowers have been used to color food and cakes [2]. This statement is supported by Andarwulan [3], who states that butterfly pea flower extract can be utilized as a food coloring without affecting the aroma and taste of the food. The use of butterfly pea flowers asa natural coloring agent has been reported in popsicles and jelly candies [4].

Butterfly pea flower (Clitoria ternatea L.) is a source of anthocyanin antioxidants and a natural blue coloring that grows wild in the tropical regions of Asia, including Indonesia [5]. According to Chusak [6], consuming products utilizing butterfly pea flower extract can increaseantioxidants in the blood without experiencing hypoglycemia and may reduce blood sugar levels. The primary compound of the blue anthocyanin in butterfly pea flowers is delphinidin glucoside [7].

Consumer demand for food products over the last decade has tended towards foods that contribute to health or provide nutrition, prevent diseases, and improve physical and mental health [8]. The addition of canna edulis flour can enhance the nutritional content of instantcream soup. Canna edulis is a tuberous herb with a higher carbohydrate content (88.2%) and has significant nutritional value compared to other tubers. This advantage is the reason forusing canna edulis as a starch addition in instant cream soup andalso for diversifying food in instant cream soup products. This is because the instant cream soups available in the market onlyuse cornstarch as a source of starch.

According to the Directorate of Nutrition of the IndonesianMinistry of Health (1981) as cited by Rukmana [9] the nutritional composition of canna edulis per 100g is 22.60g carbohydrates, 1.00g protein, 0.11g fat, 21.00mg calcium, 70.00mg phosphorus, 1.90g iron, 0.10mg vitamin B1, 10.00mg, vitamin C, and 70g water content. According to an article published by the Potato North Carolina Sweet Commission, among 58 types of vegetables studied, it was found that canna edulis is the best food on the list. Canna edulis is a sweet, fat-free food containing 76.9% of the daily value of vitamin A and 65% of vitamin C in one serving. Canna edulis flour is also beneficial for health as it is gluten-free, contains a good source of fiber for digestion, and is low in calories, aiding in weight management. One of the techniques for making instant cream soup is by using the Vacuum Drying Technique.

The production of instant cream soup products can be carried out through various drying methods involving heat; however, this may result in a reduction of nutritional content in the food ingredients. One drying method that is considered to protect heat-sensitive compounds is the Vacuum Drying method (Rotary Vacuum).

The vacuum dryer is one of the drying methods that has the advantage of maintaining the quality of the drying product, especially for heat-sensitive materials, with operating conditions required at low temperatures and pressures below 1 atm [10].

2. Materials and Methods

2.1. Materials

The ingredients used in the process of making butterfly pea flower extract are butterfly pea flowers (Clitoria ternatea L.) obtained from the Gudangkurma Bandung store. The ingredients used in making instant cream soup include canna edulis flour obtained from MAG Stores, North Jakarta, cornstarch, powdered full cream milk, sugar, salt, powdered garlic, powdered onion, powdered black pepper, and margarine. The materials used for analysis in this study are distilled water, filter paper, carbon tape, Kjeldahl salt, concentrated H_2SO_4 solution, 0.1 N HCl solution, PP indicator, 0.1 N NaOH solution, Luff Schoorl solution, 6 N H_2SO_4 solution, KI powder, standard sodium thiosulfate solution, amylum solution, 10 N H_2SO_4 solution, DPPH powder, methanol PA solution, DPPH solution, and DPPH test solution. The equipment used in the process of making instant cream soup includes a digital scale, frying pan, spatula, baking pan, chopper, vibratory screen (80 mesh), and rotary vacuum drying. The tools used for analysis in this study are an oven, chemical glassware, analytical balance, dropper pipette, volumetric pipette, graduated pipette, funnel, burette, filler, retort stand, clamp, volumetric flask, stirring rod, crucible, desiccator, crucible tongs, oven, muffle furnace, Erlenmeyer flask, and filter paper.

2.2. Preparation of Butterfly Pea Flower Extract

The preparation of butterfly pea flower extract involves sorting fresh butterfly pea flowers. Subsequently, they are washed for 5 minutes, followed by draining. The flowers are then soaked in a ratio of 1:5 between butterfly pea flowers and distilled water for 48 hours. Next, the mixture undergoes filtration to separate the butterfly pea flower extract from the dried residue of the flowers.

2.3. Preparation of Instant Cream Soup

The preparation of instant cream soup is carried out by cooking, which involves mixing butterfly pea flower extract, ganyong flour, cornstarch, full cream milk powder, salt, sugar, garlic powder, onion powder, black pepper powder, and margarine at a temperature of 60°C for 15 minutes. Once the cream soup preparation is complete, it undergoes tempering at a room temperature of 25°C, followed by a drying process at 70°C for 11 hours using a Rotary Vacuum Dryer. Subsequently, a size reduction process is conducted to reduce the size and achieve a powdered form of the cream soup. The product is then sieved using an 80-mesh screen.

2.4. Chemical Analysis of Instant Cream Soup

2.4.1. Moisture Content Analysis

Moisture content analysis is one of the important laboratory chemical analysis methods in the food industry. This moisture content test is used to determine the quality and resistance of food to possible spoilage. Some examples of testing methods are the gravimetric method and the oven method. The gravimetric method is an analytical chemistry method that determines the amount of a known substance and component by measuring the weight of the component after it has been separated into its pure state. The procedure for analyzing the water content using the gravimetric method involves heating an empty cup in an oven at 105ºC for 30 minutes, then placing it into a desiccator for 15 minutes and weighing it (W0). Then, 2 grams of the sample is placed in a cup that has a known weight and weighed (W1), then dried in the oven at 105ºC for 3 hours. After that, it is placed in a desiccator for 15-30 minutes, and the cup and its contents are weighed and dried again for 1 hour. This process is repeated until a constant weight (W2) is achieved. Moisture content can be calculated using:

$$\text{Moisture Content } (\%) = \frac{(w1 - w2)}{(w1 - w2)} x\ 100\%$$

Description:
W_0: Weight of empty cup (g)
W_1: Weight of cup + initial sample (before drying process) (g)
W_2: Weight of cup + constant sample (after drying process) (g)

2.4.2. Ash Content Analysis

Ash is an inorganic substance from the residual combustion of an organic material [11]. Theprinciple of this analysis is to oxidize all organic substances present at high temperatures (around 550°C), then weigh the remaining material after the combustion process. The procedureis carried out by smoothing the sample and weighing 2 grams on a porcelain chair that has a known weight. then dried in a furnace at a temperature of 500-600^{0}C for 3 to 5 hours. The furnace is turned off and waited until it cools, then the porcelainis heated in the oven for 15 minutes. Then the porcelain is cooled in a desiccator and the final weight is weighed. then theash content is calculated by the formula:

$$\text{Ash Content } (\%) = \frac{(w1 - w2)}{(w1 - w0)} x\ 100\%$$

Description:
W_0: Weight of empty cup (g)
W_1: Weight of cup + initial sample (g)
W_2: Weight of cup + constant sample (after drying process) (g)

2.4.3. Protein Content Analysis

Testing of protein content is done by weighing the sample to be between 0.1 and 0.5 g, which is then placed into a 100 mL Kjeldahl flask. The sample is then deconstructed (heated to boiling) until the solution becomes a clear green and SO2 disappears. The solution is allowed to cool and is transferred to a 50 mL flask, diluted with distilled water to the mark, and placed into a distillation device. It is then added with 5-10 mL of 30-33% NaOH and distilled. The distillate is collected in a solution of 10 mL of 3% boric acid and a few drops of indicator (0.1% bromcresol green solution and 0.1% methyl red solution in 95% alcohol, mixed separately and combined with 10 mL of bromcresol green and 2 mL of methyl red). The solution is titrated with 0.02 N HCl solution until it turns pink, and the protein content in the material is calculated using the formula:

$$\text{Protein Content } (\%) = \frac{(VA\ -\ VB)HCl\ x\ N\ HCl\ x\ 14{,}007}{W\ Sample\ x1000} x\ 100\%$$

Description:
VA: ml HCl for sample titration
VB: ml HCl for blanket titration
N: normality of the standard HCl used,14,007: atomic weight of Nitrogen
W: Weight of sample (g)

2.4.4. Fat Content Analysis

Determination of fat content is to oxidize organiccompounds at 105°C and weigh the remaining substances afterthe combustion process. determination of fat content using the Soxhlet method [12]. The procedure for analyzing thefat content of the Soxhlet method is carried out by weighing a sample of 5 grams and wrapped in filter paper and then placed on a

Soxhlet extraction device mounted on a condenser and a fat flask placed below it. Hexane solvent was poured into the fat flask sufficiently according to the size of the Soxhlet used and refluxed for at least 16 hours until the solvent fell back into the fat flask. The solvent in the fat flask is distilled and collected. The fat flask containing the extracted fat is then driedin an oven at 105ºC for 5 hours. The fat flask was then cooled in a desiccator for 20-30 minutes and then weighed. Fat contentwith the soxhlet method can be calculated using the following

formula:

$$\text{Fat Content } (\%) = \frac{(w1 - w0)}{Ws} x\ 100\%$$

Description:

W_0: Weight of empty cup (g)

W_1: Weight of cup + initial sample (before drying process) (g)

W_s: Weight of sample (g)

2.4.5. Carbohydrate Content Analysis

The procedure carried out to determine carbohydrate content is to carefully weigh 5 grams of the sample into a 500 ml Erlenmeyer flask. Add 200 ml of 3% HCl solution, then boil for 3 hours with upright cooling. Cool and neutralize using 30% NaOH solution (with litmus or phenolphthalein), and add a little 3% CH3COOH so that the atmosphere of the solution is slightly acidic. Transfer the contents into a 500 ml volumetric flask and mark it, then filter. Pipet 10 ml of the filtrate and place it into a 500 ml flask, add 25 ml of Luff solution (with a pipette), a few boiling stones, and 15 ml of distilled water. Heat the mixture with a fixed flame for 10 minutes, then cool and slowly add a solution of 15 ml of 20% KI and 25 ml of 25% H2SO4. Then titrate using 0.1 N sodium thiosulfate solution with the indicator used, namely 0.5% amylum. The carbohydrate content with the Luff-Schoorl method can be calculated using the following formula:

2.4.6. Anthocyanin Content Analysis

Anthocyanin Content Analysis Procedure pH- Differential-Lambert Beer Method according to Giusti and Wrolstad [13]. The first step is making a buffer solution, thereare two buffer solutions, namely potassium chloride buffer andsodium acetate buffer. For the preparation of 0.0025 M potassium chloride buffer (pH 1), one liter of the solution is obtained from mixing 1.86 grams of KCl with 980 mL of distilled water in a beaker, then the pH is measured and adjustedto obtain Ph 1 by adding concentrated HCl. After that, the solution was transferred into a volumetric flask and filled with distilled water until the solution reached a volume of 1 liter. For the preparation of 0.4 M sodium acetate buffer solution (pH 4.5), one liter of solution was obtained from mixing 54.43 grams with 960 mL of distilled water in a beaker. After that, thepH was measured and adjusted until a pH 4.5 solution was obtained using concentrated HCl, and then the solution was transferred into a volumetric flask and adjusted with distilled water until the solution reached a volume of 1 liter.

The spectrophotometer was turned on and allowed to stand for ± 30 minutes before being used for measurement. The correct dilution factor must first be determined by diluting the sample with KCl buffer (pH 1) until the absorbance of the sample at 510 nm is less than 1.2 (optimum absorbance range 0.2-0.8). After that, the final volume of the sample was compared with the initial volume in order to obtain the dilution volume. The sample dilution factor is x mL of sample dissolved into a test tube containing x mL of KCl buffer pH 1 or sodium acetate buffer, pH 4.5, and then shaken. Each buffer is put into a cuvette, and then the cuvette is inserted into the spectrophotometer to be measured at the wavelengths to be used (510 and 700 nm) so that the spectrophotometer can be zeroed. The 510 nm wavelength is the maximum wavelength for cyanidin-3-glucoside, and the 700 nm wavelength is the wavelength used to correct for the presence or absence of sediment still present in the sample. If it is completely clear, then the absorbance value at 700 nm is zero. Each sample solution was dissolved with potassium chloride buffer pH 1 and sodium acetate pH 4.5 with a predetermined dilution factor. Samples dissolved using pH 1 buffer were allowed to stand for 15 minutes, as well as samples dissolved using pH 4.5 buffer, before measurement. The absorbance of the reconstituted sample (A) was measured using the formula. The concentration of anthocyanin pigment in the sample was calculated using the following formula:

Calculation of levels in the sample using the following formula:

$$A = (A510 - A700)pH\ 1{,}0 - (A510 - A700)pH\ 4{,}5$$

$$\text{Anthocyanin concentration } \left(\frac{\text{mg}}{\text{L}}\right) = \frac{(AxBMxFPx1000)}{cxb}$$

Description:

c: concentration (M) or (mol/L)

A: Absorbance of anthocyanin sample at the measured wavelength ε: molar absorptivity of cyanidin-3-glucoside = 26900L/(mol.cm) b: cuvette thickness = 1 cm

BM: molecular weight of cyanidin-3-glucoside = 448.8 g/molFP = Dilution Factor

2.5. Physical Analysis of Instant Cream Soup

2.5.1. Dissolution Time Analysis

Weigh 5 grams of the sample and then dissolve it in 50 mLof water, followed by stirring until homogeneous. Record the time taken for the sample to completely dissolve in the water [14].

2.5.2. Color Intensity Testing Analysis

The principle of color intensity research using color readers through a color exposure system follows the CIE system with three color receptors, namely L, a, and b Hunter. The color intensity testing procedure begins with the preparation of the materials to be used. Then, the material to be observed for color is placed in plastic. The color reader is turned on using the L, a, b system. Furthermore, the color reader is calibrated, and the white color is selected; the calibration results are stored. The tip of the receptor is attached to the sample until the light is on. The results obtained are then recorded [14].

2.5.3. Scanning Electron Microscope (SEM)

SEM testing is carried out by inserting the sample into the specimen chamber, the sample is prepared first by attaching thepowder to the double carbon tape that has been attached to the holder. After that, blow air using a blower towards the powder to ensure that the powder sticks firmly to the carbon tape. If there is powder that is not firmly attached, it is feared that the powder will be sucked in during the SEM vacuuming process [15].

2.6. Statistical Analysis

The experimental design model used in this research is a Randomized Block Design (RBD) with a 3x3 factorial pattern, where each design consists of three factors with two replications, resulting in 18 experimental units. The treatment design in this study consists of two factors, namely the concentration of butterfly pea flower extract (T) and the addition of canna edulis flour (G). The treatment factor of butterfly pea flower extract concentration (T) consists of three levels: 5%, 10%, and 15%. The addition of canna edulis flour.

(G) consists of three levels: 10%, 20%, and 30%.

Table 1.
Effect of the addition of canna edulis flour on the dissolutiontime of instant cream soup (seconds).

Addition of canna edulis flour (G)	Dissolution Time
g1 (10%)	45.45 ± 0.74c
g2 (20%)	36.67 ± 0.29b
g3 (30%)	32.00 ± 0.43a

Note: Each different letter indicates a significant differenceat the 5% level.

3. Results and Discussion

3.1. Physical Response

3.1.1. Dissolution Time

The effect of the addition of canna edulis flour on the dissolution time of instant cream soup (seconds). Based on the table above, it can be observed that the variance in the additionof canna edulis flour in each treatment yields significantly different dissolution times. In the provided data, treatment g1 (10%) showed the longest dissolution time at 45.45 seconds, while treatment g3 (30%) exhibited the fastest dissolution timeat 32.00 seconds. This is attributed to the increasing addition ofcanna edulis flour, resulting in a faster dissolution time.

According to Fenema [16], lower moisture content in instant powder leads to a quicker dissolution time. High moisture content in the product can decrease the solubility level due to water presence disrupting the dissolution process, leading to clumping upon water addition.

3.2. Color Intensity Testing

L*

Table 2.
The Influence of Butterfly Pea Flower Extract Concentration onthe Color Intensity (L*) of Instant Cream Soup.

Concentration of butterfly pea extract	L*
t1 (5%)	66.49 ± 1.11[c]
t2 (10%)	64.27 ± 1.03[b]
t3 (15%)	60.63 ± 0.98[a]

Note: Each different letter indicates a significant difference atthe 5% level.

Based on the table above, it can be observed that the effect of butterfly pea flower extract concentration on each treatmentresults in significantly different L* color intensity values. The lowest L* color intensity value was found in treatment t3 (15%)with a value of 60.63, while the highest L* color intensity valuewas observed in treatment t1 (5%) at 66.49. This is due to the fact that an increase in the concentration of butterfly pea flowerextract leads to a lower L* value.

According to Rosjadi [17] in his research, the L degree value of instant rice decreased as the concentration of butterfly pea extract increased. This decrease in color intensity is influenced by butterfly pea, which contains anthocyanin pigments, resulting in a dark blue color. This color pigment is responsible for the decrease in brightness of the instant cream soup a*.

Table 3.
The influence of the interaction between butterfly pea flower extract concentration and addition of canna edulis flour on thecolor intensity (a*) of instant cream soup.

Concentrationof butterfly pea Extract (T)	Addition of canna edulis flour (G)		
	g1(10%)	g2(20%)	g3(30%)
t1(5%)	b 1.43 ± 0.03 A	a 1.14 ± 0.04 A	c 1.91 ± 0.02 A
t2(10%)	a 2.16 ± 0.06 B	b 2.46 ± 0.02 B	c 2.78 ± 0.10 B
t3(15%)	b 3.31 ± 0.04 C	a 3.11 ± 0.03 C	c 3.47 ± 0.03 C

Note: Each different letter indicates a significant difference at the 5% level (lowercase letters are read horizontally, uppercaseletters are read vertically).

Based on the table above, it is concluded that the factors of Butterfly Pea Flower Extract Concentration (T), the addition of Canna Edulis Flour (G), and the interaction effect of Butterfly Pea Flower Extract Concentration (T) and the addition of Canna Edulis Flour (G) significantly influence the color intensity a*.b*.

Table 4.
The influence of the interaction between butterfly pea flower extract concentration and addition of canna edulis flour on thecolor intensity (b*) of instant cream soup.

Concentration of butterfly pea extract (T)	Addition of canna edulis flour (G)		
	g1(10%)	g2(20%)	g3(30%)
t1(5%)	b -0.91 ± 0.40 C	a -1.60 ± 0.41 C	b -0.92 ± 0.39 C
t2(10%)	c -2.45 ± 0.37 B	b -2.72 ± 0.38 B	a -3.18 ± 0.36 B
t3(15%)	b -3.40 ± 0.52 A	b -3.53 ± 0.53 A	a -4.36 ± 0.51 A

Note: Each different letter indicates a significant difference at the 5% level (lowercase letters are read horizontally, uppercaseletters are read vertically).

Based on the table above, it is concluded that the factors ofButterfly Pea Flower Extract Concentration (T), addition of Canna Edulis Flour (G), and the interaction effect of Butterfly Pea Flower Extract Concentration (T) and Addition of Canna Edulis Flour (G) significantly influence the color intensity b*.

3.3. Scanning Electron Microscope (SEM)

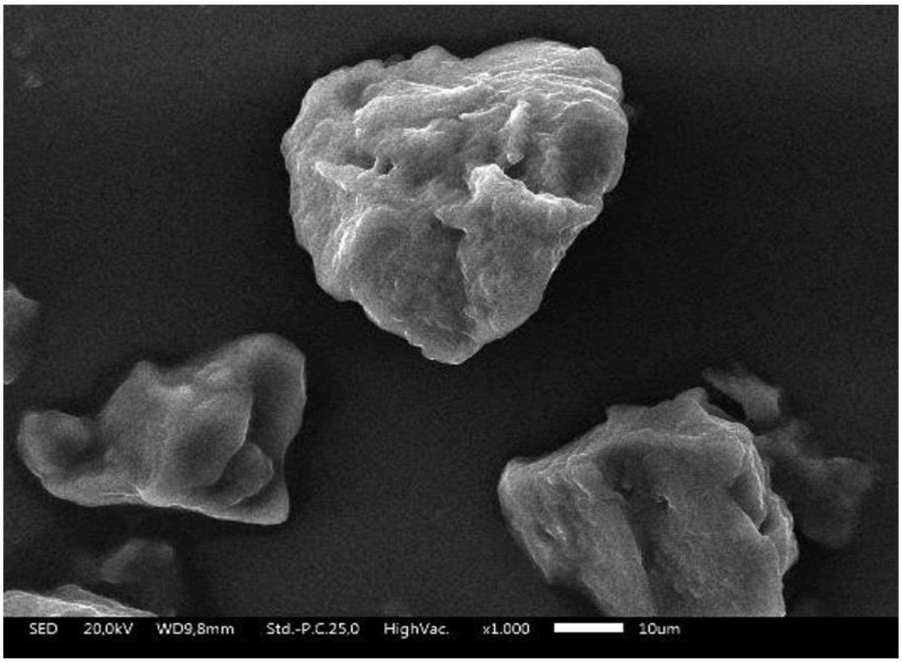

Figure 1.
SEM with 1,000x magnification.

Based on the observed morphology using Scanning ElectronMicroscopy (SEM) above, the instant cream soup particles exhibit irregular shapes, and there is agglomeration (clumping)among particles, indicating that they are not completely separated. Consequently, the particle surfaces appear to beirregularly bound to each other. When enlarged, the particles resemble corn kernels, with pores and an oily appearance.

According to Järvenin [18], agglomeration describes the tendency of small particles in a suspension to join together to form larger aggregates. Ostwald's law explains the tendency forthe formation of larger (secondary) particles from smaller (primary) particles after nucleation and primary particle growth.The agglomeration process will cease once the stability of the secondary particles is achieved. Through this agglomeration process, the resulting particle size becomes larger (secondary particles).

4. Chemical Response

4.1. Moisture Content

Table 5.
The Effect of Adding Canna Flour on the Moisture Content ofInstant Cream Soup (%)

Addition of canna edulis flour (G)	Moisture Content (%)
g1 (10%)	5.76 ± 0.17^{c}
g2 (20%)	5.36 ± 0.10^{b}
g3 (30%)	4.28 ± 0.30^{a}

Note: Each different letter indicates a significant difference atthe 5% level.

Based on the table above, it can be observed that the variance in the addition of canna flour in each treatment resultsin significantly different moisture contents. From the data, the highest moisture content was found in treatment g1 (10%) at 5.76%, while the lowest was in treatment g3 (30%) at 4.28%. This proves that the higher the addition of canna flour, the lower the moisture content of the instant cream soup.

According to Rosalina et al. [19], the moisture content decreases as the addition of canna flour increases. This is attributed to the fact that canna flour does not contain gluten, asfound in wheat flour. The low gluten content results in weaker water-binding capacity, thus facilitating the release of water molecules during the drying process.

4.2. Ash Content

Table 6.
The effect of butterfly pea flower extract concentration on the ash content of instant cream soup (%).

Concentration of butterfly pea extract (T)	Ash Content (%)
t1 (5%)	1.27 ± 0.10^{a}
t2 (10%)	2.34 ± 0.18^{b}
t3 (15%)	3.41 ± 0.20^{c}

Note: Each different letter indicates a significant difference atthe 5% level.

Based on the table above, it can be observed that the variance in the addition of butterfly pea flower extract concentration in each treatment results in significantly differentash contents. From the data, the highest ash content was found in treatment t3 (15%) at 3.41%, while the lowest was in treatment t1 (5%) at 1.27%. This demonstrates that the higher the concentration of butterfly pea flower extract, the higher theash content of the instant cream soup. This is attributed to the fact that butterfly pea flower (Clitoria ternatea) contains potassium with a content of 125 mg/100g [20].

Table 7.
The Effect of Adding Canna Edulis Flour on the Ash Content ofInstant Cream Soup (%)

Addition of canna edulis flour (G)	Ash Content (%)
g1 (10%)	2.18 ± 1.01^{a}
g2 (20%)	2.34 ± 1.08^{b}
g3 (30%)	2.49 ± 1.12^{c}

Note: Each different letter indicates a significant difference at the 5% level.

Based on the table above, it is evident that the variance in the addition of canna edulis flour in each treatment results in significantly different ash contents. From the data above, the highest ash content was found in the treatment g3 (30%) at 2.49%, while the lowest ash content was in the treatment g1 (10%) at 2.18%. This demonstrates that the higher the addition of canna edulis flour, the higher the ash content of the instant cream soup.

According to Rosalina et al. [19], the ash content increases with the increasing addition of canna edulis flour. This is because the ash content of food products depends on the mineralcontent of the ingredients used. As per the Directorate of Nutrition, Ministry of Health of Indonesia [21] cited in Rukmana [9], in every 100 g of canna tuber, there are 21 mgof calcium, 1.9 mg of iron, and 70 mg of phosphorus.

4.3. Protein Content

Table 8.
The Effect of Addition of Canna Edulis Flour on the Protein Content of Instant Cream Soup (%).

Addition of canna edulis flour (G)	Protein Content (%)
g1 (10%)	5.71 ± 0.03[a]
g2 (20%)	5.47 ± 0.005[b]
g3 (30%)	5.11 ± 0.02[c]

Note: Each different letter indicates a significant difference at the 5% level.

Based on the above table, it can be observed that the variation in the addition of Canna edulis flour in each treatment results in significantly different protein content. In the data above, treatment G1 (10%) has a protein content of 5.71%, while treatment G3 (30%) has a protein content of 5.11%. It can be concluded that the higher the addition of Canna edulis flour, the lower the protein content in instant cream soup.

This is due to the fact that, according to Rosalina et al. [19], thedecrease in protein content in canna edulis flour substitution isbecause the protein content in canna edulis flour is lower than that of wheat flour, so the higher the amount of canna edulis flour, the lower the protein content.

According to Rosalina et al. [19], gluten content generally determines the protein content in Canna edulis flour. The higher the gluten, the higher the protein in Canna edulis flour. Canna edulis flour has a protein content of 0.954%.

Table 9.
The Effect of Addition Canna Edulis Flour on the Fat Contentof Instant Cream Soup (%).

Addition of canna edulisflour (G)	Fat Contentof (%)
g1 (10%)	6.26 ± 0.02[a]
g2 (20%)	6.48 ± 0.02[b]
g3 (30%)	6.59 ± 0.02[c]

Note: Each different letter indicates a significant difference at the 5% level.

4.4. Fat Content

Based on the table above, it can be observed that the variance in the addition of canna edulis flour in each treatment results in significantly different fat content. In the data above, itis found that treatment g1 (10%) has a fat content of 6.26%, while treatment g3 (30%) has a fat content of 6.59%. The higherthe addition of canna edulis flour, the higher the fat content in instant cream soup. According to Rosalina et al. [19], the fatcontent increases with the increasing addition of canna edulis flour. This is because canna edulis flour has a fat content of 0.252%.

Table 10.
The Effect of Addition Canna Edulis Flour on the Carbohydrate Content of Instant Cream Soup (%).

Addition of canna edulis flour (G)	1. Carbohydrate Content (%)
g1 (10%)	68.82 ± 0.05a
g2 (20%)	70.79 ± 0.01b
g3 (30%)	72.61 ± 0.06c

Note: Each different letter indicates a significant difference at the 5% level.

4.5. Carbohydrate Content

Based on the table above, it is evident that the variation in the addition of canna edulis flour in each treatment results in significantly different carbohydrate contents. From the data, it is noted that treatment g1 (10%) has a carbohydrate content of 68.82%, while treatment g3 (30%) has a carbohydrate content of 72.61%. The higher the addition of canna edulis flour, the higher the carbohydrate content in instant cream soup. According to Rosalina et al. [19], the carbohydrate content increases with the rising addition of canna edulis flour. This is attributed to the high carbohydrate content in canna edulis flour,which is about 84.726%.

According to Sugito and Hayati [22], the carbohydrate content is influenced by the content of other nutritional components. The higher the content of other nutritional components, the lower the carbohydrate content, andvice versa. The components that affect the amount of carbohydrate, determined by the by difference method, includewater, ash, protein, and fat.

4.6. Calorie Calculation

Food is considered nutritious if it contains sufficient nutrients for the body and its quality aligns with the body's needs. The food we consume every day can be divided into several groups, namely protein, fat, carbohydrates, vitamins, minerals, water, fiber, and oxygen.

In addition to the quality of the food, determined by the amount of chemicals in it, the quantity of food should also be considered. The amount of food in each group should be balanced. Balanced food is food that contains a source of energy (carbohydrates, protein, and fat), building materials, and regulators suitable for each person's needs. To express the quantity of food, the value of these nutrients is expressed in calories. There are 4 calories in 1 gram of protein, 4 calories in 1 gram of carbohydrates, and 9 calories in 1 gram of fat. The amount of calories needed depends on the type of work, age, gender, physical condition (healthy or sick), weight, and climate.

This instant cream soup also provides a source of energy orcalories from protein, carbohydrates, and fat. From 55 grams ofinstant cream soup, it provides a total of 203.92 calories, as shown in Table 11.

Table 11.
The nutritional content of instant cream soup per 55 grams of ingredients.

Nutrient Content	Unit	Total
Calorie	Calorie	203.92
Protein	gram	2.82
Carbohydrate	gram	39.97
Fat	gram	3.64

Table 12.
Anthocyanin Content of the best sample

Code	Absorbance Value				Absorbance	Total Anthocyanins (mg/g)
	Absorbance 510		Absorbance 700			
	pH-1.0	pH-4.5	pH-1.0	pH-4.5		
$t3_{g3}$	0.124	0.052	0.063	0.019	0.028	0.00467

4.7. Anthocyanin Content

Based on the table above, the analysis results for total anthocyanin content using the pH differential method on the selected sample, specifically treatment t3g3 with a 15% concentration of butterfly pea flower extract and a 30% ganyong addition, showed a total anthocyanin content of 0.00467 mg/g.

According to Sugito and Hayati [22] anthocyanins are water- soluble or polar compounds. Therefore, the suitability of the solvent used will affect the anthocyanin extract obtained. The extraction process of anthocyanins is influenced by the amount of solvent and temperature. The more acidic the pH of the anthocyanin during storage, the better the stability of the colorant. Storage at 10°C and without light exposure is preferable over room temperature storage with light exposure [23].

5. Organoleptic Response

The hedonic test is an assessment of preference levels. In this study, the hedonic test was conducted with 30 panelists. Thepanelists were asked for their personal opinions regarding theirliking or disliking.

The hedonic scale can be converted into a numerical scale with quality numbers according to the level of liking. The instant cream soup produced was analyzed for its sensory characteristics, including color, aroma, taste, and texture. This study utilized a six-point hedonic scale indicating levels of preference: 1 (Dislike very much), 2 (Dislike), 3 (Slightly dislike), 4 (Slightly like), 5 (Like), 6 (Like very much).

5.1. Color

Color is a characteristic of a material that originates from the dispersion of the light spectrum, as well as the shiny light from the material affected by reflected light. Color is not a substance, but rather a sensory sensation due to the stimulationof a beam of radiation energy impacting the visual senses or eyes. Color can be the primary parameter determining the levelof consumer acceptance of a product because it plays the most important role in determining quality [24].

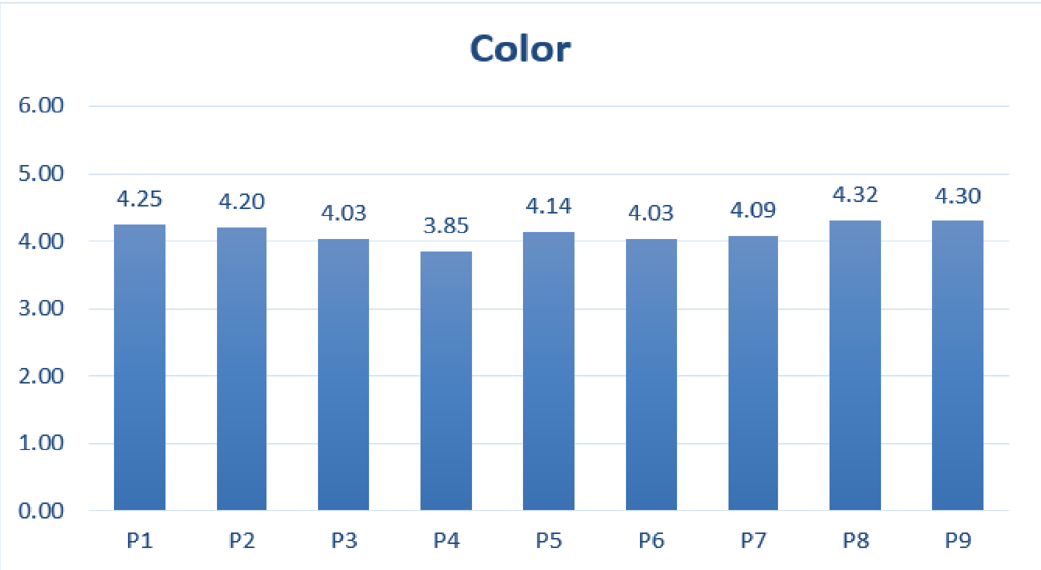

Figure 1.
Organoleptic Response of Color.

Based on Figure 1, the results of the organoleptic response analysis of color attributes it shows that the average organoleptic value ranges from 3.85 - 4.32, which means that the panelists like the cream soup with the addition of butterfly pea flower extract and canna edulis flour. Sample P8 (t2 10%, g3 30%) is the most preferred sample with a score of 4.32.

5.2. Flavor

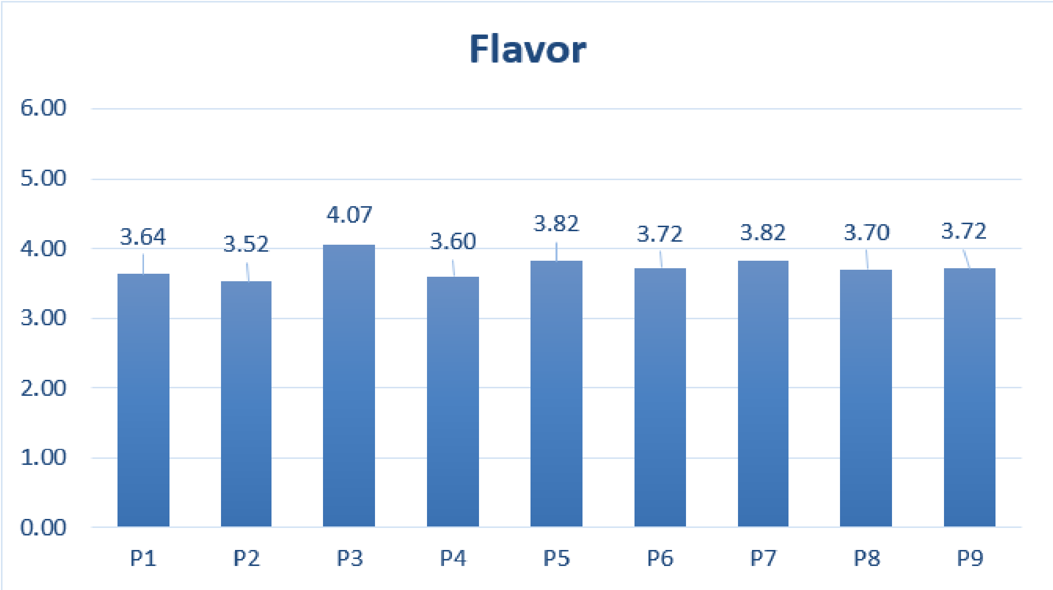

Figure 2.
Organoleptic Response of Flavor.

Based on Figure 2, the results of the organoleptic response analysis of flavor attributes it show that the average organoleptic value ranges from 3.52 - 4.07, which means that the panelists like the cream soup with the addition of butterfly pea flower extract and canna edulis flour. Sample P3 (t2 10%, g3 30%) is the most preferred sample with a score of 4.07.

5.3. Taste

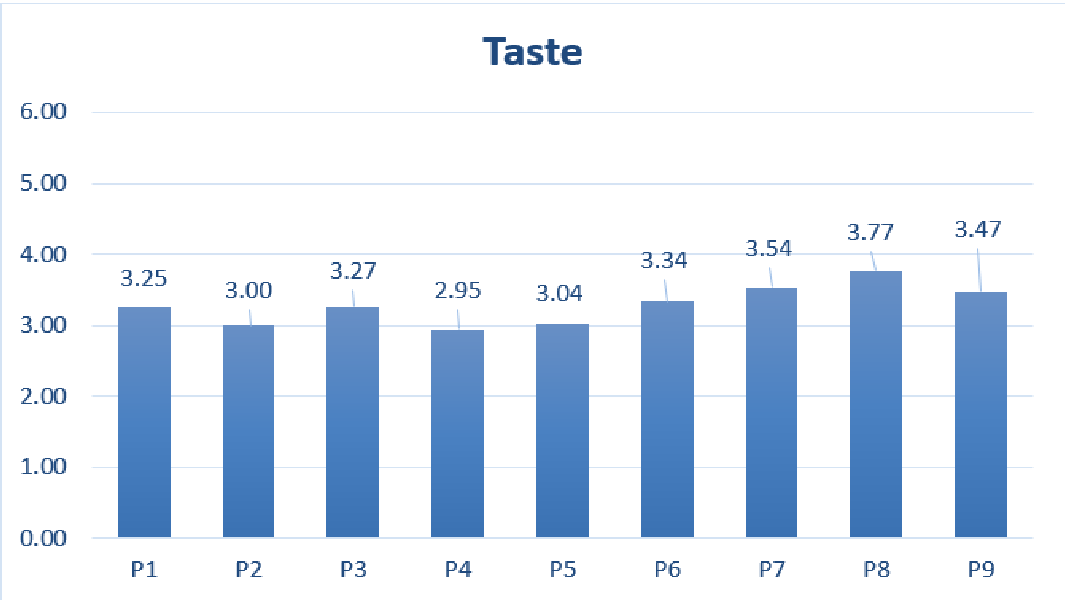

Figure 3.
Organoleptic Response of Taste.

Taste is a significant factor in a food product; the assessment of flavor perception reflects the consumer'sacceptance of a food item, generally evaluated through human sensory judgment [22]. Based on Figure 3, the results of the organoleptic response analysis of taste attributes it show that the average organoleptic value ranges from 2.95 – 3.77, which means that the panelists like the cream soup with the addition of butterfly pea flower extract and canna edulis flour. According to the organoleptic test results for the taste attribute, it is found that sample P8 (t2 10%, g3 30%) achievedthe highest organoleptic score, amounting to 3.77.

5.4. Texture

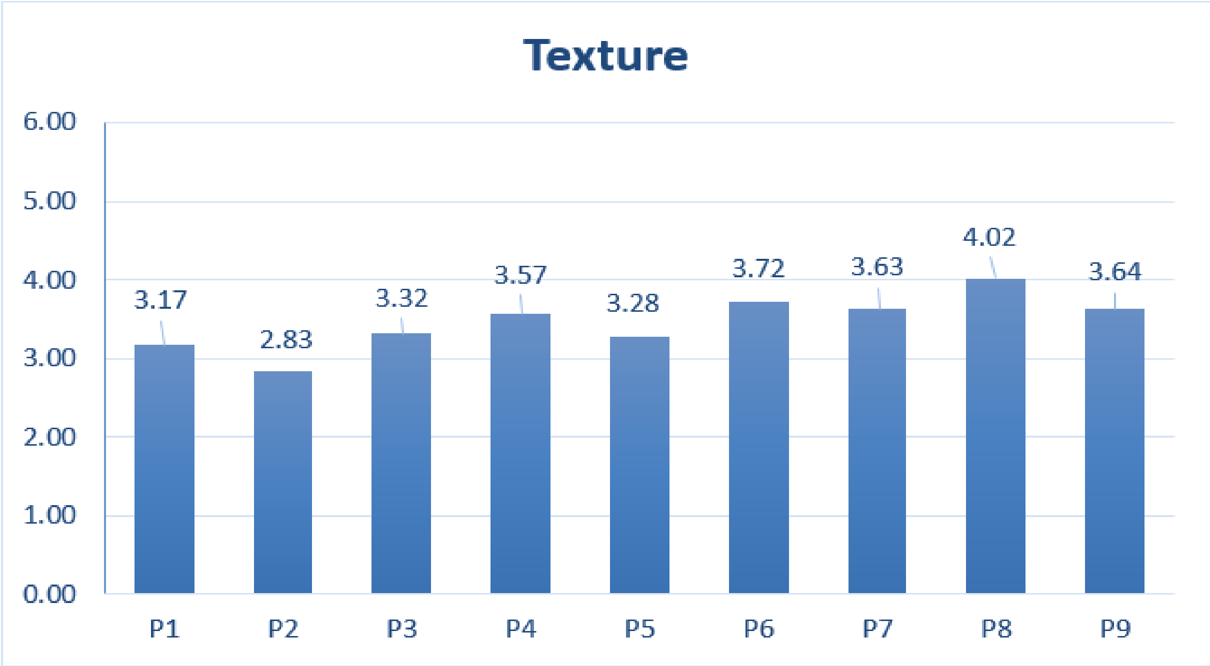

Figure 4.
Organoleptic Response of Texture.

Based on Figure 4, the results of the organoleptic response analysis of texture attributes it shows that the average organoleptic value ranges from 2.83 – 4.02, which means that the panelists like the cream soup with the addition of butterfly pea flower extract and canna edulis flour. According to the organoleptic test results for the texture attribute, it is found that sample P8 (t2 10%, g3 30%) achieved the highest organoleptic score, which is 4.02.

6. Conclusion

Based on the research findings, it can be concluded that the concentration of butterfly pea flower (Clitoria ternatea L.) extract affects the color intensity values (L*), (a*), (b*), and ash content. The addition of arrowroot flour (Canna edulis Kerr) impacts the dissolution time, color intensity values (a*), (b*), moisture content, ash content, protein content, fat content, and carbohydrate content. The interaction between the concentration of butterfly pea flower extract and the addition of arrowroot flour influences the color intensity values (a*) and (b*).

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