



Dr. Rahmawati, ST, M.Si. <rahmafarasara@usahid.ac.id>

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Effect of the formulation of fermented white corn flour and glutinous rice flour on the quality of instant cream soup powdered

N A Pratiwi¹, R Rahmawati¹, R R Maulani², D Hunaefi³, D Saputra⁴, Tj Muhandri³

1. Food Technology Program, Faculty of Food Technology and Health, Sahid University, Jl Prof. Dr. Supomo Nomor 84 Jakarta Selatan 12870
2. Study Program of Postharvest Technology, School of Life Science and Technology, Institut Teknologi Bandung
3. Food Science and Technology Department, Faculty of Agriculture Technology, IPB University, Bogor
4. Department of Food Technology, Bina Nusantara University, Jakarta

E-mail : rahmafarasara@usahid.ac.id

Abstract. Cream soup is a product that is quite popular as a breakfast menu, a hot appetizer, a warm meal during cold weather, and a snack. The purpose of this research was to study the characteristics of instant cream soup powder and cream soup products made from fermented white corn flour achieved from RSM optimization and glutinous rice flour formulas. The formulation of fermented white corn flour and glutinous rice flour were 0:100; 55:45; 70:30; 85:15; and 100:0. The qualities of instant cream soup powder were determined by rehydration power and moisture content. The qualities of cream soup product were determined by viscosity and sensory analysis (color, aroma, viscosity and taste). The results showed that the cream soup can be made until the formulation of fermented white corn flour and glutinous rice flour is 100:0. The characteristics of the instant cream soup powder were 1,91 mL/g rehydration power and 5,97% moisture content, while the cream soup product had 551,23 cP viscosity, white color (score 4,62), a slightly strong corn aroma (score 3,75), a slightly thick consistency (score 3,98), a slightly strong corn taste (score 3,9) and favored by the panelists (score 4,27).

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1. Introduction

Cream soup is a product that is quite popular as a breakfast menu, a hot appetizer, a warm meal during cold weather, and a snack [1]. Cream soup is a type of thick soup made using stock / clear soup thickened with thickening agent then added with milk or cream. The name of the cream soup is adjusted to the most ingredients used in the soup. Examples: Cream of Corn Soup, Cream of Chicken Soup, and Cream of Asparagus [2].

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The development of cream soup in Indonesia using local raw materials has been carried out. Sunyoto et al. [3] made an instant cream soup from sweet potatoes, where [4], made instant cream soup with a combination of soybeans and brown rice, and [5], made instant cream soup based on nixtamal corn. These cream soups were generally liked by the panelists. To increase the type of cream soups used fermented local white corn flour. The fermentation process of local white corn flour was the result of

optimization by RSM. The results showed that this flour is suitable for making cream soup because it has good heat resistance, which had a low breakdown viscosity value of 308.50 ± 14.85 cP [6]. This value is lower than white waxy wheat flour (1803 ± 113.3 cP) and higher than Glutinous rice flour (1931 ± 11 cP) [7]. Flours that have a low breakdown viscosity value will produce a stable solution when heating [8].

To increase the thickness of the fermented corn cream soup, glutinous rice flour was added. The purpose of this research was to study the formulation of fermented white corn flour and glutinous rice flour on the quality of instant cream soup powder and cream soup product.

2. Materials and Methods

2.1. Material

The ingredients used in the cream soup were fermented white corn flour, glutinous rice flour, water, powdered milk, chicken stock, sugar, corn oil, pepper, garlic, and monosodium glutamate flavor enhancer.

The equipment used for producing cream soup and quality testing were analytical scales, glassware, processing equipment, Brookfield viscometer, WTB Binder FD 56 oven with Blower 57 Liters, and sensory test equipment.

2.2. Methods

2.2.1. Fermented white corn flour preparation as a result of RSM optimization

2.2.1.1. Corn

Corn type used in this research was local white corn Anoman variety that was obtained from the Cereal Crops Research Institute, Maros, Sulawesi, Indonesia. The corn was made into grits for a standardized fermentation process. Kernels of corn were washed with drinking water (corn: water = 1:4 w/v) and drained on a sieve. After that, the kernels were grinded using pin disc mill and sieved to produce grits with a diameter of ≥ 4 mm. The grits were then washed with drinking water (grits: water = 1:4 w/v) for 30 minutes and then drained and ready for fermentation [9].

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2.2.1.2. Microorganisms

Microorganisms used as a starter culture prepared were *Penicillium chrysogenum*, *Penicillium citrinum*, *Aspergillus niger*, *Rhizopus stolonifer*, *Rhizopus oryzae*, *Fusarium oxysporum*, *Acremonium strictum*, *Candida famata*, *Kodamaea ohmeri*, *Candida krusei*, *inospicua*. The microorganisms used were previously isolated and identified from spontaneous fermentation of corn grits [10].

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2.2.1.3. Culture preparation and enumeration

One loop of each mold was streaked onto fresh Potato Dextrose Agar (PDA) slant and then incubated at 30°C for five days. After five days, molds were harvested by scrapping, suspended in 10 mL sterile water and appropriately diluted for enumeration using haemocytometer. Yeast culture was prepared as above, but incubation was carried out at 30°C for two days. Yeast enumeration was also carried out using haemocytometer [8].

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2.2.1.4. Cocktail yeast mold culture powder preparation

Cocktail yeast mold powder was made by inoculating mold and yeast [10] in sterilized corn flour. Mold and yeast were added as much as 10% of the weight of sterile water added to sterile corn flour. After being incubated at 30°C for 5 days, the cultures were oven-dried at 50°C for 24 hours. Furthermore, the dried cocktail yeast mold culture was ground and sieved with a strainer size of 60 mesh. The powder that passed the filter was cocktail yeast mold powder [11].

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There were 2 kinds of cocktail yeast mold culture made, namely CC and AC. CC consists of *Penicillium chrysogenum*, *Penicillium citrinum*, *Aspergillus niger*, *Rhizopus stolonifer*, *Rhizopus oryzae*, *Fusarium oxysporum*, *Acremonium strictum*, *Candida famata*, *Kodamaea ohmeri*, *Candida*

krusei/ inconspicua, while AC consists of *Penicillium citrinum*, *Aspergillus niger*, *Acremonium strictum*, and *Candida famata* [12].

2.2.1.5. Fermented white corn flour preparation

First, the corn was made into grits. After that the grits was soaked in water (1:2) and added with CC cocktail yeast mold powder 2% (w/v). AC cocktail yeast mold powder added at 16 and 32 hours of fermentation. Then, the observation was done according to the fermentation time (48 hours). Furthermore, the grits was dried and made into flour. Last, the corn flour was used to make an instant cream soup powder [6].

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2.2.2. Instant cream soup powder preparation

The process of making instant cream soup powdered was a modification of Abdurrasyid's research [5]. The process consists of several stages. First, mixed the full cream milk powdered and sugar in water until it dissolved. Second, once homogeneous, added stock and stirred until homogeneous. Next, put in the fermented white corn flour and rice flour according to the formulas. The mixture was stirred until homogeneous. After that, the solution was heated at 95 °C for 1-2 minutes until it reached the desired consistency. Then the fire was put out. After that, added the corn oil, salt, pepper, garlic, and MSG to the mixture and stirred until homogeneous. Once homogeneous, the dough was dried in a cabinet dryer at 50°C for 48 hours. And last, the dried cream soup was ground and sieved with a strainer size of 60 mesh. The powder that passed the filter was instant cream soup powdered. The instant cream soup powder preparation scheme can be seen in figure 1.

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2.2.3. Cream soup product preparation

Cream soup products were made by weighing 50 g of instant cream soup powder and put in water as much as 350 ml. After that boiled this solution at 95 °C for 2-3 mins [13].

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2.2.4. Statistical analysis

Obtained data was then processed using T-test and ANOVA with SPSS (Statistical Package for the Social Sciences) software to analyze the effect of the formulation of fermented white corn flour and glutinous rice flour on the quality of instant cream soup powdered.

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3. Results and Discussion

3.1. The qualities of instant cream soup powdered

3.1.1. The rehydration power

The rehydration power showed how much the ability of a food ingredient to absorb water. The rehydration power of instant cream soups powdered ranged from 1.91±0.06 ml/g to 2.9±0.09 ml/g. Data showed that the higher the glutinous rice flour formulation results in higher rehydration power as well (figure 2). Anova test results showed that the formulation of fermented white corn flour and glutinous rice flour significantly affected rehydration power ($\alpha = 0.01$). Rehydration power is influenced by the amylose and amylopectin content of the material, where amylopectin has the ability to absorb water higher than amylose [14]. The higher rehydration power in formulations containing glutinous rice flour is higher because glutinous rice flour has a high amylopectin content, which is around > 99% [15].

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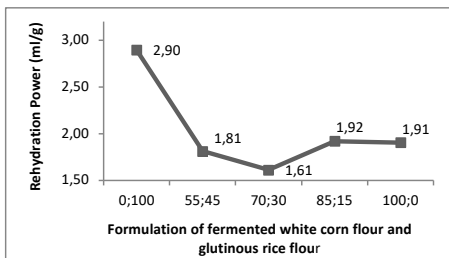


Figure 2. The rehydration power (ml/g) of the formulation of fermented white corn flour and glutinous rice flour

3.1.2. Moisture content

Moisture content is an important factor in food ingredients because it can affect product quality, consumer acceptance, freshness and the product shelf life. The moisture content of instant cream soup powdered ranged from $5.97 \pm 0.46\%$ to $6.60 \pm 0.91\%$, where the moisture content of the cream soup powdered was relatively stable (figure 3).

Anova test results showed that the formulation of fermented white corn flour and glutinous rice flour did not significantly affect the moisture content ($\alpha = 0.01$). Generally, the moisture content of the product was influenced by the moisture content of the material. Moisture content of fermented white corn flour was 7.35% [6] and glutinous rice flour was 6.17%. The similarity in water content of these two ingredients was thought to cause the formulation to not affect the instant cream soup powdered.

Based on the Indonesian National Standard (SNI) 01-4967-1999 [16] the moisture content of instant cream soup powder meets the requirements, which is less than 8%. Food ingredients with 3-7% water content can reduce the growth of microorganisms and damaging chemical reactions, such as hydrolysis and fat oxidation [17].

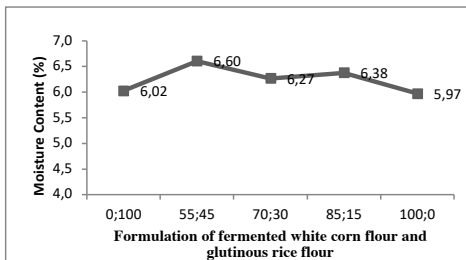


Figure 3. The rehydration power (ml/g) of the formulation of fermented white corn flour and glutinous rice flour

3.2. The qualities of cream soup product

3.2.1. Viscosity value

Viscosity or thickness is an important condition for cream soup products. Generally, consumers want a cream soup that is not too thick and not runny. Commercial cream soup has a viscosity of 810 cP. The viscosity of the cream soup in this study was tested using a Brookfield Viscometer with a spindle number of 2/62, rpm 60, and a temperature of 70°C. The measurement results showed that the viscosity was between 551.23 ± 2.48 cP - 864.58 ± 7.11 cP. Where the higher the glutinous rice formulation, the viscosity is getting thicker (figure 4).

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Anova test results showed that the formulation of fermented white corn flour with glutinous rice flour significantly affected the viscosity of fermented corn cream soup ($\alpha = 0.01$). The viscosity is influenced by the amylopectin content, where when heated, the amylose leaves the network and the amylopectin branch chains absorb water. This causes the viscosity increased [18]. If the amylopectin content increases, it will make the cream soup thicker. Generally, the fermented corn cream soup has a lower viscosity than nisktamal corn cream soup, which is 933.33 ± 23.09 cP [5] and sweet potato instant cream soup added with milk, which is 1080 cP [3].

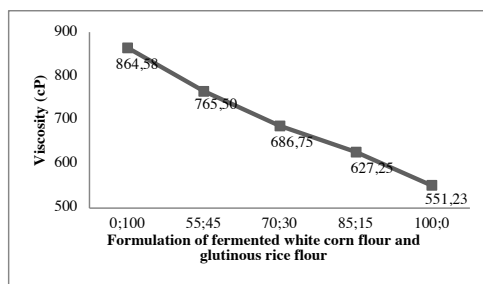


Figure 4. Viscosity value (cP) of the formulation of fermented white corn flour and glutinous rice flour

3.2.2. Sensory analysis

Sensory analysis was carried out to determine the quality of the product and accepted by the panelists using the human senses. The analysis was carried out to test the color, aroma, thickness and taste. The sensory quality of the cream soup formulated by fermented white corn flour and glutinous rice was presented in Table 2, while the panelists' preferences for fermented corn cream soup were shown in Table 3.

Table 2. The sensory quality (score) of the cream soup formulated by fermented white corn flour and glutinous rice

Parameter	Formulation C : R				
	0 : 100	55 : 45	70 : 30	85 : 15	100 : 0
Color	4,68±0,14	4,68±0,10	4,58±0,08	4,47±0,10	4,62±0,08
Aroma	3,45±0,25	3,62±0,30	3,42±0,10	3,73±0,19	3,75±0,23
Thickness	4,20±0,35 ^b	3,82±0,13 ^a	3,67±0,21 ^a	4,03±0,23 ^{ab}	3,98±0,60 ^{ab}
Taste	3,62±0,46	3,75±0,26	4,22±0,10	3,85±0,13	3,90±0,15

Score description : **Color:** (1) yellow; (2) light yellow; (3) yellowish; (4) yellowish white; (5) white; **The aroma of corn:** (1) very weak; (2) weak; (3) somewhat weak; (4) slightly strong; (5) strong; **Thickness:** (1) very thin; (2) dilute; (3) slightly watery; (4) slightly thick; (5) thick; **Corn taste:** (1) very weak; (2) weak; (3) somewhat weak; (4) slightly strong; (5) strong.

The results showed that the formulation of fermented white corn flour with glutinous rice flour did not significantly affect the color, aroma and taste ($\alpha = 0.05$), but significantly affected the viscosity ($\alpha = 0.05$). In table 3, it can be seen that the corn cream soup has a yellowish white-white color (score 4.47 - 4.68), the aroma of corn is slightly strong - strong, the thickness is slight thick (score 3.67 - 4.2), and the taste of the corn is slightly strong (score 3.62 - 4.22).

The yellowish white color in the cream soup is thought to be due to the presence of protein and reducing sugar in fermented white corn flour and glutinous rice flour. Protein and reducing sugar in instant cream soup powdered caused Maillard reaction when heating [19]. This caused the corn cream soup to turn yellowish.

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The aroma and taste of corn in the cream soup were slightly strong due to the heating process which can evaporate the aromatic compounds of corn flour and the addition of spices can reduce the aroma and taste of the corn. While, viscosity test with sensory is in line with the viscosity test, where the higher the glutinous rice flour formulation results in a thicker cream soup. This is due to the higher amylopectin content. When heating, amylopectin will absorb water and increase viscosity [18].

Table 3. The panelists' preferences (score) of the cream soup formulated by fermented white corn flour and glutinous rice

Parameter	Formulation C : R				
	0 : 100	55 : 45	70 : 30	85 : 15	100 : 0
Color	4,23±0,03	4,22±0,19	4,22±0,08	4,17±0,13	4,30±0,13
Aroma	4,18±0,03	4,25±0,09	4,25±0,05	4,32±0,08	4,22±0,08
Thickness	4,48±0,16 ^b	4,28±0,03 ^{ab}	4,17±0,10 ^a	4,17±0,06 ^a	4,27±0,16 ^{ab}
Taste	4,28±0,10	4,27±0,12	4,23±0,19	4,25±0,09	4,32±0,20

Score description: (1) very dislike; (2) dislike; (3) slightly like it; (4) like; (5) really like

The preference test results showed that the Panelists liked the fermented white corn cream soup (score 4.17 - 4.48) for all formulations. The ANOVA test results showed that the formulation of fermented white corn flour and glutinous rice flour had no significant effect ($\alpha = 0.05$) on color, aroma, and taste preference, while this formulations had a significant effect on viscosity preference ($\alpha = 0.05$). This indicated that the corn cream soup can be made up to 100% fermented white corn flour.

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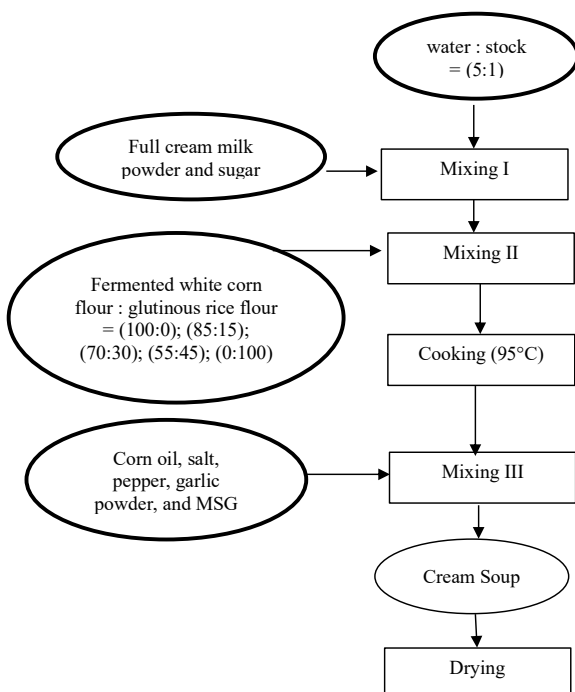
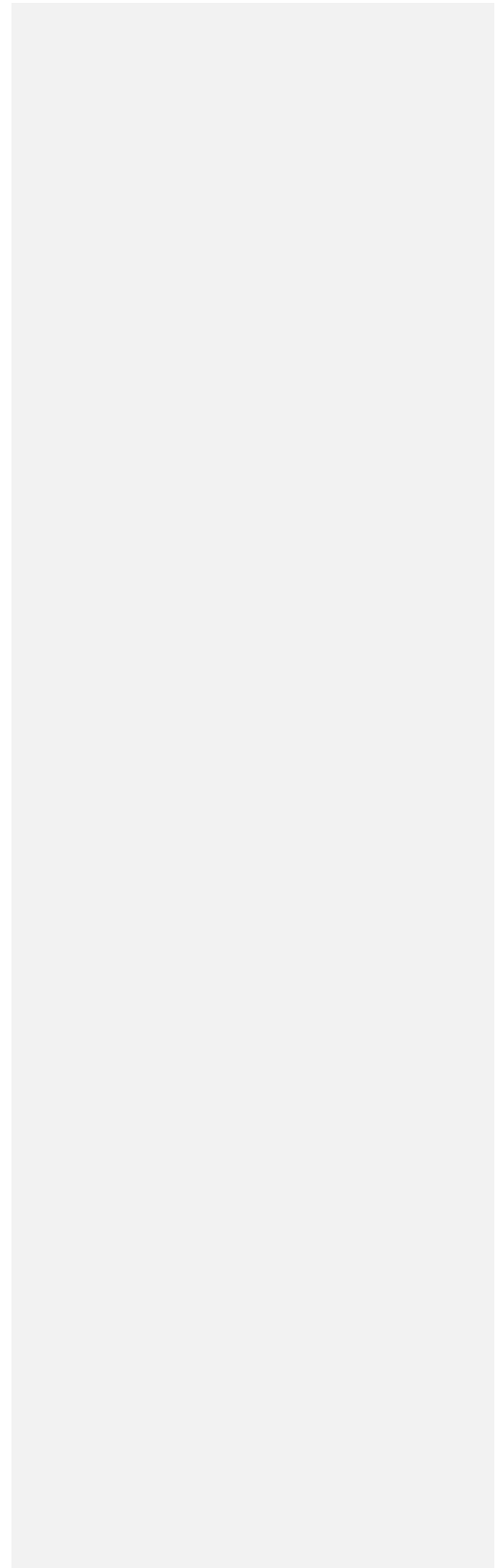


Figure 1. Instant cream soup powder preparation scheme





Dr. Rahmawati, ST, M.Si. <rahmafarasara@usahid.ac.id>

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Fri, Dec 4, 2020 at 10:18 PM

Dear Editor in Chief
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Thank you for this information, I will revised it.

Best regards
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