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# Pengaruh Ekstrak Kacang Tanah Sebagai Pengganti Susu Sapi Terhadap Kualitas Fisik Dan Sensoris Diplomat Cream

## *The Effect Of Peanut Extract As A Cow's Milk Substitute On The Physical And Sensory Quality Of Diplomat Cream*

**Nadia Salma Maharani[a*], Mutiara Dahlia[b], Efrina[c]**
Culinary Education, Faculty of Engineering, Universitas Negeri Jakarta[a,b]
Culinary Arts and Food Service Management Study Program, Faculty of Engineering, Universitas Negeri Jakarta[c]
nadiasalmamaharanii@gmail.com[a]

***Abstract***

*The increasing demand for plant-based food products has encouraged the development of alternatives to cow's milk in pastry products. This study aimed to analyze the effect of different peanut-to-water ratios in peanut extract on the physical quality and sensory attributes of diplomat cream. An experimental method was applied using three treatment ratios of peanut to water: 1:1, 1:1.5, and 1:2. Physical quality was evaluated through pH and volume consistency tests using ANOVA, while sensory quality was assessed using the Kruskal-Wallis test with 45 semi-trained panelists. Results indicated that peanut extract ratio significantly affected the pH value of diplomat cream (F-count 31.63 > F-table 5.143), with mean pH values of 5.41, 5.39, and 5.28 for the 1:1, 1:1.5, and 1:2 treatments, respectively. Duncan's test showed that the 1:2 treatment differed significantly from the other two treatments. Volume consistency was not significantly affected (F-count 0.29 < F-table 5.143). Sensory evaluation revealed no significant differences in color, consistency, texture, and sweetness among treatments, but significant differences were found in peanut aroma (H-count 7.17 > $\chi^2$-table 5.991) and peanut flavor (H-count 13.17 > $\chi^2$-table 5.991). The 1:2 treatment produced the most neutral sensory characteristics, closest to the control diplomat cream. Therefore, peanut extract at a 1:2 ratio is recommended as the best formulation to substitute cow's milk in diplomat cream production.*

***Keywords:*** *Diplomat Cream, Peanut Extract, Physical Quality, Sensory Quality*

Abstrak

Meningkatnya permintaan akan produk pangan berbasis nabati telah mendorong pengembangan alternatif susu sapi dalam produk *pastry*. Penelitian ini bertujuan untuk menganalisis pengaruh perbedaan rasio kacang tanah terhadap air dalam ekstrak kacang tanah terhadap kualitas fisik dan atribut sensori *diplomat cream*. Metode eksperimental diterapkan dengan menggunakan tiga perlakuan rasio kacang tanah terhadap air: 1:1, 1:1,5, dan 1:2. Kualitas fisik dievaluasi melalui uji pH dan konsistensi volume menggunakan ANOVA, sedangkan kualitas sensori dinilai menggunakan uji Kruskal-Wallis dengan melibatkan 45 panelis semi-terlatih. Hasil penelitian menunjukkan bahwa rasio ekstrak kacang tanah berpengaruh signifikan terhadap nilai pH *diplomat cream* (F-hitung 31,63 > F-tabel 5,143), dengan nilai pH rata-rata masing-masing sebesar 5,41; 5,39; dan 5,28 untuk perlakuan 1:1, 1:1,5, dan 1:2. Uji Duncan menunjukkan bahwa perlakuan 1:2 berbeda secara signifikan dibandingkan dua perlakuan lainnya. Konsistensi volume tidak dipengaruhi secara signifikan (F-hitung 0,29 < F-tabel 5,143). Evaluasi sensori menunjukkan tidak adanya perbedaan signifikan pada warna, konsistensi, tekstur, dan tingkat kemanisan antarperlakuan, namun ditemukan perbedaan signifikan pada aroma kacang tanah (H-hitung 7,17 > $\chi^2$-tabel 5,991) dan rasa kacang tanah (H-hitung 13,17 > $\chi^2$-tabel 5,991). Perlakuan 1:2 menghasilkan karakteristik sensori yang paling netral dan paling mendekati *diplomat cream* kontrol. Oleh karena itu, ekstrak kacang tanah dengan rasio 1:2 direkomendasikan sebagai formulasi terbaik untuk menggantikan susu sapi dalam pembuatan *diplomat cream*.

**Kata kunci:** Diplomat Cream, Ekstrak Kacang Tanah, Kualitas Fisik, Kualitas Sensori

## 1. Introduction

The increasing demand for plant-based food products has encouraged the development of dairy alternatives in various food applications, including pastry


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products (Plamada et al., 2023). This trend is driven not only by changes in consumer lifestyles but also by increasing awareness of health, environmental sustainability, and dietary restrictions, particularly among individuals with lactose intolerance and cow's milk protein allergy (Maris & Radiansyah, 2021). Despite the growing popularity of plant-based milk alternatives, cow's milk remains the primary ingredient in many pastry products, limiting product accessibility for consumers who cannot consume dairy products (Nyambayo et al., 2024).

Several studies have investigated the utilization of plant-based milk as a substitute for cow's milk in food products. Almond milk, soybean milk, oat milk, and other legume-based milk have been reported to provide satisfactory nutritional and functional properties while improving product accessibility for lactose-intolerant consumers (Damayanti et al., 2018; Maris & Radiansyah, 2021). Among various legumes, peanut has attracted attention because of its relatively high protein content, unsaturated fatty acids, and abundant local availability in Indonesia (Romadani et al., 2023). Previous research by Habsari et al., (2023) demonstrated that peanut extract could be successfully applied in ice cream production, although its characteristic peanut aroma remained one of the main sensory challenges.

In pastry products, particularly diplomat cream, the replacement of cow's milk with peanut extract may influence both physical properties and sensory characteristics because milk contributes to the stability, texture, flavor, and overall acceptability of the product (El-Sayed et al., 2025; Murtaza et al., 2025). However, studies investigating peanut extract as a substitute for cow's milk in diplomat cream are still very limited. Most previous studies have focused on other dairy products or plant-based beverages, while information regarding its application in pastry cream products remains unavailable.

Therefore, this study aimed to analyze the effect of different peanut-to-water ratios in peanut extract as a substitute for cow's milk on the physical quality and sensory quality of diplomat cream. The findings are expected to provide scientific information regarding the potential utilization of peanut extract as a locally available plant-based milk alternative for pastry applications while supporting the development of dairy-free pastry products.

## 2. Method

This study was conducted at the Bread and Cake Laboratory, Culinary Education Study Program, Faculty of Engineering, Universitas Negeri Jakarta, from July 2025 to June 2026. An experimental method was employed using a Completely Randomized Design (CRD) with one experimental factor, namely the ratio of peanuts to water in peanut extract. Three treatment formulations were evaluated: 1:1, 1:1.5, and 1:2.

The independent variable was the peanut-to-water ratio in peanut extract, while the dependent variables consisted of the physical quality (pH and volume consistency) and sensory quality (color, consistency, peanut aroma, texture, sweetness, and peanut flavor) of diplomat cream.

Prior to the main experiment, a preliminary study was conducted to determine the most appropriate formulation. Four peanut-to-water ratios (1:1, 1:1.5, 1:2, and 1:3) were initially evaluated. The 1:3 ratio produced an unstable and excessively thin cream, whereas the remaining three formulations showed acceptable physical characteristics and were therefore selected for further investigation.

Peanut extract was prepared by soaking peeled peanuts, boiling them until tender, blending them with water according to each treatment ratio, filtering the mixture, and reheating the filtrate with sugar, salt, and vanilla until a homogeneous extract was obtained.

**Table 1. Ingredients for Making Peanut Extract**

| No | Ingredient | Weight (g) | Percentage (%) |
|---|---|---|---|
| 1 | Boiled Peeled Peanuts | 200 | 48.84 |
| 2 | Water | 200 | 48.84 |
| 3 | Sugar | 15 | 1.83 |
| 4 | Salt | 1 | 0.12 |
| 5 | Vanilla Flavoring | 3 | 0.37 |

Source: (Novita, 2023)

The diplomat cream formulation was identical for all treatments, with peanut extract serving as the only variable. The formulation consisted of 125 g peanut extract, 15 g egg yolk, 15 g granulated sugar, 15 g cornstarch, 2 g vanilla essence, 2 g salt, 10 g unsalted butter, and 90 g whipping cream.

**Table 2. Formula of Peanut Extract Diplomat Cream in the Three Treatments**

| Ingredient Name | Weight (g) | Percentage (%) |
|---|---|---|
| Peanut Extract | 125 | 45.62 |
| Egg Yolk | 15 | 5.47 |
| Sugar | 15 | 5.47 |
| Cornstarch | 15 | 5.47 |
| Vanilla Essence | 2 | 0.73 |
| Salt | 2 | 0.73 |
| Butter | 10 | 3.65 |
| Whipping Cream | 90 | 32.85 |
| Total | 274 | 100 |

Diplomat cream was prepared by first producing pastry cream using peanut extract, egg yolk, granulated sugar, cornstarch, vanilla essence, salt, and butter. After cooling to room temperature, the pastry cream was gently folded with whipped whipping cream until a smooth and homogeneous diplomat cream was obtained. The same formulation was applied to all treatments, with the peanut-to-water ratio in the peanut extract serving as the only experimental variable.

Physical quality was evaluated through pH measurement and volume consistency analysis. The pH value was measured using a calibrated digital pH meter with three replications for each treatment. Volume consistency was observed by measuring changes in cream volume during storage at room temperature over a six-hour period.

Sensory quality evaluation was conducted by 45 semi-trained panelists, consisting of Culinary Education students who had completed Organoleptic and Continental Cake courses. An independent panelist design was applied, in which each treatment was evaluated by 15 different panelists. The assessed sensory attributes included color, consistency, peanut aroma, texture, sweetness, and peanut flavor using a five-point quality scale.

Physical quality data were analyzed using one-way analysis of variance (ANOVA). When significant differences were detected, Duncan's Multiple Range Test was performed as a post hoc analysis. Sensory quality data were analyzed using the

Kruskal–Wallis test, followed by Tukey's test to determine significant differences among treatments.

## 3. Results And Discussion

### *Physical Quality*

### pH Value

The average pH values of diplomat cream varied among treatments according to the different peanut-to-water ratios used in peanut extract. The average pH values obtained for the 1:1, 1:1.5, and 1:2 treatments were 5.41, 5.39, and 5.28, respectively, indicating a gradual decrease in pH as the proportion of water increased. Statistical analysis using one-way ANOVA showed that the peanut extract ratio significantly affected the pH value of diplomat cream ($F = 31.63$; $p < 0.05$). Furthermore, Duncan's Multiple Range Test indicated that the 1:2 treatment differed significantly from the 1:1 and 1:1.5 treatments.

The decrease in pH may be attributed to changes in the concentration of dissolved solids caused by increasing the amount of water during peanut extract preparation. Variations in the composition of plant-based emulsions can influence the acidity of the final product because the balance between proteins, lipids, and water changes during formulation (Quezada et al., 2024). Nevertheless, all formulations remained within a mildly acidic pH range that is generally acceptable for cream-based pastry products. Similar findings were reported by Adrianto et al., (2020) who stated that ingredient composition significantly influences the pH characteristics of emulsion-based food systems.

### Volume Consistency

The average volume consistency values of diplomat cream were 34.40 $cm^3$, 34.38 $cm^3$, and 34.59 $cm^3$ for the 1:1, 1:1.5, and 1:2 treatments, respectively. One-way ANOVA indicated that the different peanut-to-water ratios had no significant effect on volume consistency ($F = 0.29$; $p > 0.05$). During six hours of storage at room temperature, all formulations maintained relatively stable volume with only negligible differences among treatments.

This finding suggests that increasing the proportion of water in peanut extract did not adversely affect the structural stability of diplomat cream. The stability was likely maintained by the interaction of egg yolk, cornstarch, butter, and whipping cream, which collectively formed a stable emulsion network capable of retaining air and moisture. Similar observations have been reported by Dianingsih et al., (2016), who explained that emulsion stability is largely determined by the viscosity and structural characteristics of the system rather than minor differences in water content. Likewise, Nurfadilah M. Kasim et al., (2025) reported that starch and protein components contribute substantially to maintaining the physical stability of plant-based dairy alternatives.

### Sensory Quality

Table 5 summarizes the Kruskal–Wallis test results for all sensory attributes evaluated in this study. Overall, differences in the peanut-to-water ratio did not significantly affect color, consistency, texture, or sweetness ($p > 0.05$). However, peanut aroma and peanut flavor were significantly affected ($p < 0.05$), indicating that

these two sensory attributes were more responsive to variations in peanut extract concentration. Therefore, each sensory attribute is discussed individually below.

**Table 5. Recapitulation of Kruskal-Wallis Test Results for Sensory Quality of Peanut Extract Diplomat Cream**

| Sensory Quality Aspect | Average 1:1 | Average 1:1.5 | Average 1:2 | Calculated H | $\chi^2$ Table | Conclusion |
|---|---|---|---|---|---|---|
| Color | 5.00 | 4.87 | 4.87 | 0.52 | 5.991 | No significant effect |
| Consistency | 4.80 | 4.67 | 4.47 | 2.48 | 5.991 | No significant effect |
| Peanut Aroma | 3.87 | 4.20 | 4.73 | 7.17* | 5.991 | Significant effect |
| Texture | 5.00 | 4.93 | 4.73 | 1.70 | 5.991 | No significant effect |
| Sweetness | 4.40 | 4.80 | 4.80 | 3.53 | 5.991 | No significant effect |
| Peanut Taste | 2.67 | 3.40 | 4.13 | 13.17* | 5.991 | Significant effect |

*) significantly different at $\alpha = 0.05$

**Color**

The Kruskal–Wallis analysis showed that the peanut-to-water ratio had no significant effect on the color of diplomat cream ($H = 0.52$; $p > 0.05$). Although slight differences in the average sensory scores were observed among treatments, all formulations were generally perceived as having an ivory white to light cream color. This finding indicates that substituting cow's milk with peanut extract did not noticeably alter the visual appearance of diplomat cream.

The similarity in color among treatments is likely due to the naturally light color of peanut extract, which did not produce sufficient pigment differences to affect the final product. Furthermore, the use of whipping cream and pastry cream contributed to maintaining the characteristic appearance of diplomat cream. Similar findings were reported by Paput et al., (2022), who stated that peanut milk substitution did not significantly influence the color characteristics of dairy-based products because peanut extract possesses a relatively pale appearance.

**Consistency**

The consistency of diplomat cream was not significantly influenced by the peanut-to-water ratio ($H = 2.48$; $p > 0.05$). Although the 1:1 treatment achieved the highest average score, the differences among treatments were relatively small, indicating that all formulations maintained a comparable consistency.

This result suggests that varying the concentration of peanut extract was insufficient to modify the structural properties of diplomat cream. The stable consistency can be attributed to the interaction of cornstarch, egg yolk, butter, and whipping cream, which formed a stable emulsion and maintained the cream structure despite differences in water content. These findings are in agreement with Habsari et al., (2023), who reported that thickening and emulsifying agents contribute more substantially to product consistency than moderate variations in plant-based milk concentration.

**Peanut Aroma**

Unlike color and consistency, peanut aroma was significantly affected by the peanut-to-water ratio ($H = 7.17$; $p < 0.05$). The average sensory scores increased as the proportion of water increased, indicating that the characteristic peanut aroma became less intense. The 1:2 treatment received the highest score, suggesting that it

produced the most neutral aroma and was closest to conventional diplomat cream prepared with cow's milk.

The reduction in peanut aroma intensity can be explained by the dilution of volatile aroma compounds as the proportion of water increased (Ma, Ding, Shi, et al., 2024; Ma, Ding, Zhou, et al., 2024). Consequently, the characteristic aroma of peanuts became less dominant and more acceptable to the panelists. Novita (2023) explained that the aroma intensity of peanut-based products is strongly influenced by the concentration of volatile compounds released during processing. Therefore, increasing the water proportion effectively reduced the characteristic peanut aroma without adversely affecting the overall quality of diplomat cream (Liu et al., 2025; Sithole et al., 2022).

**Texture**

The peanut-to-water ratio did not significantly affect the texture of diplomat cream ($H = 1.70$; $p > 0.05$). All formulations were consistently evaluated as having a soft and smooth texture, indicating that peanut extract successfully replaced cow's milk without compromising the desirable textural characteristics of the product.

The stable texture observed in all treatments is associated with the functional roles of egg yolk, cornstarch, butter, and whipping cream in forming a stable cream matrix (Chen et al., 2025). These ingredients maintained the softness and smoothness of diplomat cream despite variations in peanut extract concentration. Similar findings were reported by Suci & Pangastuti (2024), who found that plant-based milk substitution did not significantly alter the texture of diplomat cream when an appropriate formulation was applied.

**Sweetness**

No significant difference was observed in the sweetness attribute among treatments ($H = 3.53$; $p > 0.05$). Although slight variations in average scores were recorded, all formulations were perceived as having an appropriate level of sweetness.

This finding suggests that sweetness perception was primarily determined by the amount of sucrose added to the formulation rather than by differences in the peanut extract ratio. Since the sugar concentration remained constant across all treatments, the panelists perceived a similar sweetness intensity. Lamere et al., (2021) similarly reported that sweetness is predominantly influenced by added sweeteners rather than by changes in the concentration of plant-based ingredients.

**Peanut Flavor**

Among all sensory attributes, peanut flavor exhibited the greatest response to the different peanut-to-water ratios ($H = 13.17$; $p < 0.05$). The average sensory score increased progressively from the 1:1 treatment to the 1:2 treatment, indicating that increasing the proportion of water reduced the intensity of the characteristic peanut flavor. Consequently, the 1:2 formulation produced the mildest peanut flavor and most closely resembled conventional diplomat cream.

The decrease in peanut flavor intensity is associated with the lower concentration of flavor compounds present in the diluted peanut extract. As the concentration of peanut solids decreased, the characteristic peanut taste became less dominant, resulting in a more balanced sensory profile. Similar findings were reported by Paput et al., (2022), who observed that increasing the dilution of peanut milk

reduced the perception of peanut flavor in dairy substitute products. These results indicate that adjusting the peanut-to-water ratio can improve the sensory acceptability of peanut-based diplomat cream while maintaining its desirable physical characteristics.

## 4. Conclusion

Based on the findings of this study, the peanut-to-water ratio in peanut extract influenced both the physical and sensory qualities of diplomat cream. A significant effect was observed on the pH value, peanut aroma, and peanut flavor, while no significant differences were found in volume consistency, color, consistency, texture, and sweetness. Among the tested formulations, the 1:2 peanut-to-water ratio produced the most balanced characteristics, maintaining the physical stability of diplomat cream while reducing the characteristic peanut aroma and flavor, resulting in sensory properties that were closest to those of conventional cow's milk-based diplomat cream. Therefore, peanut extract with a 1:2 ratio has the potential to serve as a plant-based alternative to cow's milk in diplomat cream production. These findings support the potential application of peanut extract as a locally available plant-based alternative to cow's milk in pastry products and provide useful information for the future development of dairy-free diplomat cream.

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