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Sensory Quality of Ice Cream with Added Kotamobagu Robusta Coffee Extract

F.S. Ratulangi[1*], N.G. Kauntu[2], D.B.J. Rumondor[3], E.H.B. Sondakh[4], J.E.M. Soputan[5]
Sam Ratulangi University
Corresponding Author: F.S. Ratulangi frietssr@unsrat.ac.id

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ABSTRACT

This study aims to determine the effect of the sensory quality of ice cream with the addition of Robusta coffee extract, as assessed in terms of aroma, flavor, color, and texture. The design used in this study was a completely randomized design with 5 treatments, and the sensory evaluation involved 30 panelists as replicates. The treatments were as follows: P0: no Kotamobagu Robusta coffee extract (0%), P1: 5% Kotamobagu Robusta coffee extract, P2: 10% Kotamobagu Robusta coffee extract, P3: 15% Kotamobagu Robusta coffee extract, and P4: 20% Kotamobagu Robusta coffee extract. The variables observed in this study were the sensory qualities of aroma, flavor, color, and texture. The observational data were analyzed using analysis of variance (ANOVA), and where differences were found, they were followed by a post-hoc test for significant differences. The results of the ANOVA for the addition of Robusta coffee extract showed a highly significant effect ($P < 0.01$) on the acceptability scores for aroma, color, and flavor, but a non-significant effect ($P > 0.05$) on the acceptability score for ice cream texture. It is concluded that the addition of Kotamobagu Robusta coffee extract up to a concentration of 20% produces ice cream with sensory qualities aroma, flavor, color, and texture that are well-liked

INTRODUCTION

Ice cream is a semi-solid food made by freezing ice cream mix or a mixture of milk, animal or vegetable fats, and sugar, with or without other food ingredients and permitted additives. Ice cream can be considered one of the most popular foods in the world and is loved by people of all ages. Ice cream is also very good for health because it is rich in nutrients and is considered a high-nutrient food (Hartatie, 2011).

The nutritional content of ice cream includes calcium, phosphorus, protein, vitamins, and minerals. The calcium and phosphorus in ice cream help maintain bone density and may help prevent osteoporosis, cancer, and hypertension. The protein content is necessary for the body to repair muscle tissue.

The vitamins in ice cream include vitamins A, D, K, and B12. Vitamin A supports eye health, vitamin K helps dissolve clotted blood cells, while vitamin B12 enhances memory and supports the nervous system. The nutritional content of 100 g of ice cream is 20.6 g of carbohydrates, 4 g of protein, and 12.5 g of fat (Astawan, 2010).

The plantation sector plays a vital role in Indonesia's economy, particularly for certain commodities such as coffee. Coffee plants have long had a significant impact on local communities because they thrive in the region and yield good harvests (Nurfadillah, 2019). East Bolaang Mongondow, as a coffee-producing hub in

North Sulawesi, contributes significantly to coffee production. The Modayag District of Kotamobagu is the largest coffee-producing area and has the most extensive coffee-growing land in East Bolaang Mongondow Regency (Saputro *et al*., 2023).

Coffee is a beverage produced from plants; it is made by brewing ground coffee. Ground coffee consists of coffee beans that have been roasted, ground, or crushed into a fine powder. This is because both ground coffee and its brew possess a distinctive aroma not found in other beverages (Sakiroh and Ibrahim, 2020).

The chemical composition of coffee beans varies depending on the type of coffee, the soil in which they are grown, and the processing method. The most important chemical compounds in coffee are caffeine and caffeol. Caffeine stimulates nerve activity, while caffeol contributes to the coffee's flavor and aroma. The caffeine content in Robusta is much higher than in Arabica; even a small amount imparts a bitter taste (Janwar, 2014).

The processing process is a set of methods or techniques used to transform raw materials into finished goods with added value that can be consumed by humans or manufacturers. The smooth operation of each processing step depends heavily on the proper execution of each activity (Saputra, 2021). To process high-quality Robusta coffee powder, it must undergo various processing steps, namely: harvesting, sorting, sun-drying of red coffee cherries, dry milling, sorting of green beans, roasting, and grinding.

Sensory testing is a method used to evaluate and measure human responses to the sensory characteristics of a food product, such as taste, aroma, texture, and color. Sensory testing is important in the food industry because it provides valuable information about consumer preferences and aids in the development and processing of high-quality products (Budaraga, 2024).

In the food industry, aroma testing is considered important because it can quickly provide an assessment of whether consumers like the product or not (Soekarto, 2012).

Taste is the most important aspect of any food or beverage product. Taste also has a significant impact on consumer preferences, influencing interest in the product being tested. Taste evaluation involves the sense of taste, which encompasses sour, bitter, salty, and sweet (Rahayu *et al*., 2023).

Color is one of the factors that influence consumer response to a product such as ice cream. The more appealing the color of a food product, the more consumers will like it (Ariyanto *et al*., 2024).

Texture is a property of an ingredient or product that can be perceived through touch or taste.

Texture is a factor that influences panelists' acceptance of a product (Umar *et al*., 2024).

The purpose of this study is to examine the effect of adding Robusta coffee extract on the sensory quality of ice cream.

METHODS

The ingredients used are UHT milk, granulated sugar, chicken eggs, whipped cream, full-fat powdered milk, agar-agar, water, cucumber, and Robusta coffee extract. The equipment used includes a gas stove, pots, wooden spoons, containers, spatulas, knives, markers, ice cream scoops, ice cream cups, measuring cups, a mixer, an analytical scale, a strainer, a blender, a freezer, and sensory testing tools such as tissues, water, questionnaire paper, and writing utensils.

This study employed a completely randomized design (CRD) (Steel and Torrie, 1994) with 5 treatments evaluated by 30 sensory panelists as replicates.

The treatments in this study were arranged as follows:

P_0: Without Kotamobagu Robusta Coffee Extract

P_1: Addition of Kotamobagu Robusta Coffee Extract 5%

P_2: Addition of Kotamobagu Robusta Coffee Extract 10%

P_3: Addition of Kotamobagu Robusta Coffee Extract 15%

P_4: Addition of Kotamobagu Robusta Coffee Extract 20%

This research procedure began with the preparation of Robusta coffee extract using ground coffee obtained directly from a ground coffee producer in Kotamobagu. First, the ground coffee was weighed according to the treatment concentrations: P_1 (50g), P_2 (100g), P_3 (150g), and P_4 (200g). It was then placed in containers appropriate for each treatment. Hot water at a temperature of 92 °C is added in a 1:2 ratio, then stirred until well mixed and left to stand for 15 minutes. Filtration is performed using a white muslin cloth, yielding Robusta coffee extracts for each treatment: P_1 at 5%, P_2 at 10%, P_3 at 15%, and P_4 at 20%.

The process of making Robusta coffee ice cream begins by preparing the necessary tools and ingredients, namely: First, pour clean water (150 ml) into a saucepan and bring to a boil; add agar-agar (7 g) while stirring, then pour the mixture into 4 egg yolks that have been beaten and combined. Add 1000 ml of UHT milk, 100 g of full-cream powdered milk, 200 g of whipped cream, and 200 g of granulated sugar to a container, then cook at a pasteurization temperature of 80 °C for 10 minutes. Then remove it from the heat and pour it into a container according to the treatment protocol, and let it cool for 15 minutes. Add Robusta coffee extract according to the treatment protocol: P_0: 0%, P_1: 5%, P_2: 10%, P_3: 15%, and P_4: 20%. Stir until well blended, then mix the batter for 15 minutes.

Next, store the Robusta coffee ice cream mixture in the refrigerator at a temperature below 4 °C for 18–24 hours. Remove the Robusta coffee extract ice cream mixture from the freezer and let it sit for 5 minutes, then mix again for 15 minutes. Next, portion the mixture into 30 ice cream cups as a replicate for each treatment, then store in the freezer for 24 hours until frozen, resulting in the Robusta coffee extract ice cream product, followed by sensory analysis.

The variables observed in this study were sensory qualities (aroma, flavor, color, and texture). The rating criteria for the aroma, taste, color, and texture of Robusta coffee ice cream were as follows: 5 = strongly like, 4 = like, 3 = somewhat like, 2 = dislike, 1 = strongly dislike (Soekarto, 2012).

RESULTS AND DISCUSSION

The data on the average treatment results for panelists' ratings of the sensory quality aroma, flavor, color, and texture of ice cream containing Robusta coffee extract are presented in Table 1

Table 1. Mean Values for the Treatment Involving the Addition of Kotamobagu Robusta Coffee Extract

Variable	Treatment				
	P_0 (0%)	P_1 (5%)	P_2 (10%)	P_3 (15%)	P_4 (20%)
Aroma	3,40 [a]	3,56 [a]	3,73[ab]	3,90[bc]	4,00[c]
Flavors	3,86[a]	3,96[a]	4,06[a]	4,30[ab]	3,73[b]
Color	3,43[a]	3,70[b]	3,86[b]	4,06[bc]	4,03[c]
Texture	3,50	3,53	3,50	3,56	3,56

Note: Different superscripts on the same row indicate a statistically significant difference (P<0.05)

The Effect of Treatment on the Aroma of Ice Cream

The data from the study on the aroma of ice cream with added Robusta coffee extract ranged from 3.40 (somewhat like) to 4.00 (like). The lowest average aroma score was found in treatment P0 without added Robusta coffee extract, and the highest average score was obtained in treatment P4 with 20% added Robusta coffee extract. The higher the concentration of the Robusta coffee extract treatment, the higher the ice cream aroma likability score, and vice versa.

The results of the analysis of variance for the addition of Robusta coffee extract showed a highly significant effect ($P<0.01$) on the ice cream aroma likability scores.

The results of the Honest Significant Difference (HSD) post-hoc analysis for the addition of Robusta coffee extract showed that treatment P_0 was not significantly different ($P > 0.05$) from treatments P_1 and P_2 but was significantly different ($P < 0.05$) from treatments P_3 and P_4. Treatment P_1 was not significantly different from P_2 but was significantly different from P_3 and P_4. Treatment P_2 was the same as P_3 but different from P_4. Furthermore, treatment P_3 was different from P_4. The differences in the perceived appeal of the ice cream's aroma are due to the increasing concentration of the Robusta coffee extract treatment; as the concentration increases, the aroma becomes more appealing, indicating that each treatment has a distinct or varying effect on the ice cream's aroma. This is because the higher the concentration of Robusta coffee extract added as a treatment, the stronger and more appealing the Robusta coffee aroma becomes in the ice cream product.

According to Agustina *et al*. (2019), under varying roasting temperatures and durations, the aroma of the coffee grounds was very fragrant and unique, which was highly appreciated by the panelists. The effect of roasting temperature and duration on aroma is such that the higher the temperature and the longer the duration, the more volatiles evaporate, influencing changes in the aroma of the coffee grounds (Purnamayanti, 2017). Furthermore, Yasa (2022) states that various volatile compounds are responsible for the distinctive aroma of coffee; these volatile compounds impart the aroma and character of coffee. When coffee extract is added to ice cream, these compounds transfer to the final product and significantly influence its aromatic character.

The Effect of Treatment on the Flavor of Ice Cream

The results of the taste test for ice cream with added Robusta coffee extract ranged from 3.73 (somewhat like) to 4.30 (like). The lowest average taste score was found in treatment P4 (with added Robusta coffee extract), while the highest average score was obtained in treatment P_3 (with 15% added Robusta coffee extract).

The results of the analysis of variance for the addition of Robusta coffee extract showed a highly significant effect ($P<0.01$) on the level of acceptance of the ice cream's taste. The results of the Honest Significant Difference (HSD) post-hoc analysis for the addition of Robusta coffee extract showed that treatment P_0 was not significantly different ($P > 0.05$) from treatments P_1, P_2, and P_3, but was significantly different ($P < 0.05$) from treatment P_4. Treatment P_1 was not significantly different from P_2 and P_3, but was significantly different from P_4. Treatment P_2 was not significantly different from P_3 but was significantly different from P_2 and P_4. Treatment P_3 was not significantly different from P_4.

The differences in ice cream flavor preference were due to the increasing concentration of the Robusta coffee extract treatment, meaning that the higher the concentration, the more preferred the flavor. This indicates that the addition of Robusta coffee extract had a different or varying effect on the flavor of the ice cream for each treatment. This is

because the higher the concentration of Robusta coffee extract added as a treatment, the more the Robusta coffee flavor is preferred in the ice cream product.

The use of Robusta coffee extract affects the flavor of the ice cream because Robusta coffee extract contains caffeine, which imparts the characteristic bitter taste of coffee, while chlorogenic acid contributes to the sour and slightly astringent taste. This is consistent with Sakiroh and Ibrahim (2020), who state that chlorogenic acid is an important compound that influences the formation of aroma and flavor during coffee roasting. Furthermore, Dionesius *et al*. (2020) state that caffeine is the most important compound found in coffee, functioning as a flavor and aroma component in coffee beans.

The Effect of Treatment on Ice Cream Color

The results of the study on the color of ice cream with added Robusta coffee extract ranged from 3.43 (somewhat like) to 4.03 (like). The lowest average color score was found in treatment P_1 without added Robusta coffee extract, and the highest average score was obtained in treatment P_4 with 20% added Robusta coffee extract.

The results of the analysis of variance for the addition of Robusta coffee extract showed a highly significant effect ($P<0.01$) on the color likability scores of the ice cream. The results of the Honest Significant Difference (HSD) post-hoc analysis for the addition of Robusta coffee extract showed that treatment P_0 differed significantly ($P < 0.05$) from treatments P_1, P_2, P_3, and P_4. Treatment P_1 did not differ significantly from or was equivalent to treatments P_2 and P_3, but differed from treatment P_4. Treatment P_2 was not significantly different from or was the same as P_3, but was significantly different from P_4. Treatment P_3 was not significantly different from or was the same as P_4. The differences in ice cream color preference were attributed to the increasing concentration of the Robusta coffee extract treatment, with higher concentrations resulting in greater preference; this indicates that the addition of Robusta coffee extract has a distinct or varying effect on ice cream color across different treatments. This is because as the concentration of Robusta coffee extract added as a treatment increases, the color of the Robusta coffee in the ice cream product becomes more preferred.

According to Rahmanda (2024), color is an important attribute in sensory acceptance; the color of ice cream produced from Robusta coffee extract gives a natural and distinctive impression that panelists tend to prefer, provided it does not interfere with the taste perception or visual impression commonly associated with ice cream.

The Effect of Treatment on Ice Cream Texture

The results of the study on the texture of ice cream with added Robusta coffee extract ranged from 3.50 (somewhat like) to 3.56 (like). The lowest average texture score was found in treatment P_1 without added Robusta coffee extract, and the highest average score was obtained in treatment P_4 with 20% added Robusta coffee extract.

The results of the analysis of variance showed that the addition of Robusta coffee extract had no significant effect ($P > 0.05$) on the texture likability scores of the ice cream.

The use of Robusta coffee extract had no effect on the texture of the ice cream; that is, the addition of Robusta coffee extract was the same for each treatment. Although there were variations in the texture values of the ice cream, these were not statistically significant and were considered equivalent. The lack of effect from the addition of Robusta coffee extract is due to the fact that commercially produced and marketed coffee products contain fine, homogeneous particles, which result from a process using digital grinding and sifting machines.

The use of Robusta coffee extract can increase the thickness and affect the creaminess of ice cream. When used in the right concentration, Robusta coffee extract does not compromise the texture and can even enhance the mouthfeel of the final product. It can be concluded that the panelists equally liked the texture of the ice cream to which Robusta coffee extract was added. Although more coffee was added during ice cream production, the panelists' assessment of the ice cream's texture did

not change significantly. This may be due to the consistent fineness of the coffee and the fact that the Robusta coffee used in this study was not added in the form of ground coffee but rather as coffee extract. According to Sunarharum *et al*. (2019), adding coffee during ice cream production results in a smooth and creamy texture, which is largely determined by the fineness of the coffee powder and the method of its incorporation

CONCLUSION

Based on the results and discussion, it can be concluded that adding Kotamobagu Robusta coffee extract up to a concentration of 20% produces ice cream with desirable sensory qualities in terms of aroma, flavor, color, and texture.

Further research is needed to determine the effect of adding Kotamobagu Robusta coffee extract on the chemical and physical quality of the ice cream.

REFERENCES

Agustina, R., Nurba, D., Antono, W., & Septiana, R. 2019. The Effect of Roasting Temperature and Duration on the Physicochemical Properties of Arabica and Robusta Coffee. Proceedings of the National Seminar, 285–299.

Ariyanto, S. E., H. Alpandari, and H. H. Sridjono. 2024. The Effect of Temperature and Roasting Time on the Physical Properties of Tempur Robusta Coffee. Jurnal Galung Tropika, 13 (1): 107-116.

Astawan, M. 2010. Food Processing Technology and Nutrition. Bogor Agricultural University, Bogor.

Budaraga, I Ketut. 2024. Sensory Evaluation Techniques for Food Products. CV Hei Publishing Indonesia.

Dionesius, B., W. Mushollaeni, Yusianto, and A. Rahmawati. 2020. Characteristics of Fermented Tulungrejo Robusta (Coffea canephora) Ground Coffee Using Yeast (Saccharomyces cerevisiae). Jurnal Agro Industry. Vol. 10 (2): 129-138.

Hartatie, E. S. 2011. A Study of Formulation (Raw Materials, Stabilizers) and Production Methods on Ice Cream Quality. Gamma Journal, Vol. VII.

Janwar, A. A. 2014. The Effect of Adding Coffee (Coffea spp.) on the Quality of Pasteurized Milk. Thesis. Faculty of Animal Science. Hasanuddin University.

Purnamayanti, N. P. A., Gunadnya, I. B. P., & Arda, G. 2017. The Effect of Roasting Temperature and Duration on the Physical Characteristics and Sensory Quality of Coffee.

Rahayu, A. P., Brilliantina, Kusumasari, F. C., Fadhila P. T., Sasmita I. R. A. 2023. Sensory Evaluation of Robusta Coffee Based on Variations in Roasting Temperature and Duration (Case Study of the Kahyangan Regional State-Owned Plantation Company, Sumer Wadung Estate). Journal of Agrotechnology Science. E-ISSN: 3025-910X. Vol. 1 (2): 38-44.

Rahmanda. 2024. Acceptability Test of the Color, Aroma, Texture, and Taste of Goat Milk Ice Cream Enriched with Jangkat Robusta Coffee Powder. Thesis. Faculty of Animal Science. University of Jambi.

Sakiroh, S., and M. S. D. Ibrahim. 2020. Morphological, Anatomical, and Physiological Characteristics of Seven Superior Robusta Coffee Clones. Journal. J.TID, Vol. 7 (2): 73–82.

Saputra Randi. M. 2021. The Process and Management of Robusta Coffee Processing from Green Beans to Ground Coffee at the Nur Ground Coffee Agroindustry in Sungai Penuh

City, Kerinci Regency. Diploma III Program in Agribusiness, Faculty of Agriculture. University of Jambi.

Saputro, D. R., R. Indriani, Y. Bakari. 2023. Strategies for Developing Coffee Farming in Modayag Subdistrict, East Bolaang Mongondow Regency. Jurnal Galung Tropika. Vol. 12 (2): 138-147.

Soekarto, S. T. 2012. Organoleptic Research for the Food and Agricultural Products Industry. Liberty, Yogyakarta.

Steel, R. D., and J. H. Torrie. 1994. Principles and Procedures of Statistics: A Biometric Approach. Second edition. Translated by Bambang Sumantri. Jakarta: PT. Gramedia Pustaka Utama.

Sunarharum, W., B. F. Kiki, Y. S. Sudarminto, and N. Mokhamad. 2019. The Science of Indonesian Coffee. BPress., Malang.

Umar, S., R. Hadju, J.A.D. Kalele, A. Yelnetty, W. Utiah, S. Sakul. 2024. Physical and Organoleptic Properties of Ice Cream with Added Purple Banggai Yam (Dioscorea alata L.) Faculty of Animal Science. Sam Ratulangi University. Manado. Jurnal Zootec. Vol. 44 (1): 59-66.

Yasa, I. W. D. 2022. Quality of Ice Cream with Kintamani Coffee. Faculty of Tourism and Business. Bali. Journal of Tourism and Business Students. Vol. 01 (08): 1979-1988. EISSN: 2828-3325.