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ICE CREAM CONE FORMULATIONS FROM WHEAT FLOUR AND TOFU DREGS FLOUR ADDED WITH BEETROOT (*Beta vulgaris* L.) EXTRACT

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ABSTRACT

*Ice cream cones are a type of wafer with a cone or funnel-like shape used as a container that holds ice cream and baked in an ice cream cone maker with the basic ingredient of wheat flour, which can be added with other ingredients for innovation. A factorial completely randomized design (CRD) was employed with two factors: the ratio of wheat flour to tofu dregs flour (90:10, 80:20, 70:30) and the percentage of beetroot extract in 100 ml of water (30, 40, 50%). This study aimed to determine which ice cream cone formulation(s) from wheat flour, tofu dregs flour, and beetroot (*Beta vulgaris* L.) extract had the highest protein and betacyanin content and was most favored by consumers. Results showed that formulation with the 70:30 flour ratio and 30% beetroot extract produced the highest protein content of 13.55%, and the 90:10 flour ratio and 50% beetroot extract created cones with the highest betacyanin content of 0.074 mg/100g. The product preference test based on organoleptic properties revealed that the panelists mostly preferred cones made with the 80:20 flour ratio and 30% beetroot extract because of the resulting color (3.53, like slightly), taste (3.61, like slightly), aroma (3.78, like slightly), and crispness (4.32, like), with an overall preference of 4.07 (like).*

Keywords: beetroot, betacyanin, cone, tofu dregs flour

INTRODUCTION

Ice cream is a frozen beverage commonly served in different types of containers, including cones. Cones are a type of biscuit or wafer made primarily of wheat flour; thus, innovations are needed to discover complementary ingredients. For instance, Prayoga *et al.* (2015) reported that adding crab shell flour from *Portunus pelagicus* produces cones that can hold ice cream (leakproof) for up to 26.7 minutes and contain 9.49 mg calcium, 12.67% protein, and 3.28% water. Also, the cones are brownish yellow with a faint taste of crab shell, rice flour scent, and compact and crumbly texture. These results prove that repurposing food waste, i.e., crab shells for cone flour, can increase a product's benefit and selling price.

In tofu production, the by product called soy pulp or tofu dregs is rich in nutrients, including protein (26.6%), moisture content (0.09%), fat (18.3%), iron (0.04%), phosphorus (0.29%), and carbohydrates (41.3%) (Suryani *et al.*, 2018). However, it is still underutilized and normally thrown away as waste. According to Wati (2013), wet tofu dregs must be immediately processed to last longer and not produce an unpleasant smell. Furthermore, processing tofu dregs into flour prolongs their shelf life. This process entails drying or dehydration that reduces the typical sour and musty smell of beans as it deactivates antitrypsin and lipoxygenase (Koswara, 2009; Winarno, 2004). When formed into flour, it is easier to process tofu dregs into a wide variety of

food products. For instance, this flour can be added to ice cream cone mixtures to increase their protein content and the utilization and selling price of tofu dregs. However, because it is dark brown, the cones are also darker than those made with wheat flour. Food dyes should therefore be added to create cones with an attractive appearance. One of the food ingredients that produce natural pigments is beetroot (*Beta vulgaris* L.).

Beetroot is a purplish-red tuber that derives its color from betacyanin. Betacyanin is a food-grade natural dye but is still very little used in food processing. This red pigment has antiradical and antioxidant properties. Setiawan *et al.* (2015) found that the skin of beetroot contains betacyanin in the range of 1.6084–2.4535 mg/100g. Meanwhile, according to Sari *et al.* (2016), betacyanin in the tuber's meat varies from 0.055 to 0.089 mg/L. Adding different concentrations of beetroot paste into plant-based sausages, Prabowo *et al.* (2013) discovered that the more beetroot used, the more intense the product's redness. For 15% beetroot paste, the redness value was 26.44. Because its concentration affects the degree of redness of the sausages, beetroot can thus be used as a natural food dye.

This research was intended to formulate ice cream cones from wheat flour and tofu dregs flour added with beetroot extract that contain high protein and betacyanin and are preferred by consumers. Adding the last two ingredients creates a new formulation for ice cream cones. Tofu dregs flour is selected to

increase the nutritional value, particularly protein, and the use value of tofu dregs other than its most common utilization as fodder. A side from natural coloring, beetroot is also used to create another alternative for its currently little application. This type of cone is designed because, even though ice cream is popular, the containers used to serve it are only made from wheat flour. It is also expected to elevate the use value of the ingredients used.

RESEARCH METHODS

Tools

The tools used were a cabinet dryer, ice cream cone machine (Sonifer SF-6034), stopwatch, moisture analyzer (Shimadzu MOC63u), oven (Memmert L5/11/C6 167550), muffle furnace (SP46920), colorimeter (A11121A0442), and UV-Vis spectrophotometer (Genesys 10S).

Materials

Tofu dregs were obtained from Krajan, Mojosoongo, and beetroots were purchased at the traditional market Pasar Gede Surakarta, Indonesia. Other materials included wheat flour (Kunci Biru), sugar, margarine (Blue Band), baking powder (Koepoe Koepoe), powdered milk (Dancow), water, commercial ice cream (Walls), petroleum ether, 1.25% Na_2SO_4 , 1.25% NaOH , 1.25% H_2SO_4 , CuSO_4 , selenium, concentrated H_2SO_4 , Aqua Dest distilled water, Mr-BCG indicator tablets, 40% NaOH , 5% $\text{Na}_2\text{S}_2\text{O}_3$, 4% H_3BO_3 , 0.02N HCl , 9% ethanol, and a pH 5 buffer.

Experimental Design

A completely randomized design (CRD) was employed with two factors: the ratio of wheat flour to tofu dregs flour (90:10, 80:20, 70:30) and the percentage of beetroot extract in 100 ml of water (30, 40, 50%). Data were processed in SPSS Statistics v.25. ANOVA was used to analyze physical and chemical parameter values, and if the results showed significant differences, a post-hoc Duncan's test would be conducted at a significance level of 5%. The Kruskal-Wallis test was used in organoleptic testing based on product preferences, and further analysis with the Mann-Whitney test would be conducted at a 5% significance level only for significantly different values.

Ice Cream Cone Making

Wheat flour was mixed with tofu dregs flour according to predetermined ratios (90:10, 80:20, or 70:30) and added with baking powder, sugar, margarine, eggs, powdered milk, and then 100 ml of beetroot extract made at different concentrations (30, 40, 50%). The dough was then poured into the ice cream cone maker and baked. This technique was modified from the method used in Prayoga *et al.* (2015).

Research Parameters

Three parameters were observed: physical, chemical, and organoleptic. The physical parameters included leak resistance or structural integrity test that measures how long the cone could retain ice cream (Prayoga *et al.*, 2015), the cone's color (Anggraeni *et al.*, 2017), and yield (AOAC,

2005; Ernisti *et al.*, 2018). The chemical parameters were moisture content gauged with a moisture analyzer (Lindani, 2016), ash content with thermogravimetric method (AOAC, 1992), fat content with the Soxhlet method (AOAC, 2005), protein content with the micro-Kjeldahl method (Apriyantono *et al.*, 1989), betacyanin content with spectrophotometry (Rengku *et al.*, 2017), and crude fiber content with gravimetric analysis (Apriyantono *et al.*, 1989). The organoleptic testing involved 20 semi-trained panelists to assess color, taste, aroma, crispness, and overall preference using a five-point hedonic scale, from dislike extremely (1) to like extremely (5) (Ernisti *et al.*, 2018).

RESULTS AND CONCLUSION

Leak Resistance

This test determines how long the formulated cone can hold ice cream. During the observation, the time it took for a whole cone filled with ice cream to leak was recorded (Aprilliana, 2010). Table 1 compares the physical characteristics of cones made with different wheat flour:tofu dreg flour ratios

and beetroot extract of varying concentrations. Significant differences were observed as cones tended to have enhanced resistance with an increase in the proportion of tofu dregs flour and beetroot concentration.

According to Harijono *et al.* (2001), crude fiber in plant materials is made of complex compounds that are difficult to break down during processing, thus forming tissues with tightly bound cells and a stiff or hard texture. Sabir *et al.* (2020) stated that dough with more tofu dregs flour and less wheat flour produces harder crackers because the higher fiber content in tofu reduces porosity. Dietary fiber has the ability to absorb water, causing a product to lose brittleness (Sarwini *et al.*, 2021). Tofu dregs flour comprises 15.29% crude fiber and 56.26% dietary fiber (Sudaryati *et al.*, 2012; Sulaeman *et al.*, 2007). In contrast, wheat flour has 2.7 g/100 g dietary fiber (USDA, 2014), while beetroot contains 2% dietary fiber (Dewi, 2019). Based on the leak resistance test, the additional ingredients (i.e., tofu dregs flour and beetroot extract) produce cones that can retain ice cream longer than wheat flour alone because of their high fiber content.

Table 1 Summary of the physical analysis of ice cream cones made with wheat flour and tofu dregs flour at different ratios and beetroot extract at different concentrations

Wheat flour:tofu dregs flour ratio	% Beetroot extract	Physical analysis				
		Cone resistance	Color component			Yield
			L*	a*	b*	
90:10	30%	3.44±0.19 ^a	43.65±0.21 ^c	26.58±0.28 ^{cd}	21.44±0.13 ^c	58.10±0.30 ^{bc}
	40%	5.09±0.13 ^b	31.58±0.46 ^c	24.80±2.44 ^{bcd}	15.32±1.37 ^{cd}	59.72±1.32 ^{de}
	50%	6.78±0.62 ^c	29.23±0.21 ^b	27.05±1.10 ^d	10.03±1.45 ^a	54.00±0.58 ^a
80:20	30%	5.49±0.09 ^b	26.89±0.50 ^a	22.36±0.94 ^a	11.49±0.25 ^{ab}	60.15±0.02 ^{ef}
	40%	4.09±0.11 ^c	42.49±1.70 ^c	25.91±0.35 ^{cd}	20.07±1.98 ^c	57.00±0.24 ^b
	50%	7.34±0.30 ^g	34.85±0.50 ^d	25.49±0.78 ^{bcd}	13.03±0.86 ^{bc}	57.92±0.35 ^{bc}
70:30	30%	4.40±0.24 ^d	32.57±0.06 ^c	23.44±0.45 ^{ab}	14.94±1.05 ^{cd}	61.77±0.18 ^g
	40%	5.84±0.51 ^f	28.94±1.88 ^{ab}	24.55±0.53 ^{abc}	16.13±1.17 ^d	58.50±0.60 ^{cd}
	50%	7.73±0.57 ^h	31.80±1.32 ^c	26.12±0.10 ^{cd}	13.48±0.67 ^{bcd}	61.40±0.60 ^{fg}

Notes: Values followed by the same letter are not significantly different from one another according to Duncan's test at a 5% significance level. % beetroot extract is the concentration of beetroot per 100 ml of water.

Color Expression with the L*a*b* Model

L* values (lightness)

L* values indicate the lightness or darkness of a material on a scale of 0 to 100. Zero represents dark color or black, while 100 indicates light or white (Prabowo *et al.*, 2013). Table 1 shows that the L* values differed significantly between the flour ratios and the beetroot extract's concentrations. With more tofu dregs flour that is browner than wheat flour in the dough, the cone's color becomes darker. Also, Winanti *et al.* (2013) explained that the red color of beef sausages is more intense (less light) when added with more beetroot.

a* values (redness)

a* represents red and green: a positive value (+a*) means that the food ingredient observed is red, while a negative value (-a*) corresponds to green (Prabowo *et al.*, 2013). Table 1 shows that the a* values differed significantly between the flour ratios and the beetroot extract's concentrations. It indicates an inverse relationship between a* and the proportion of tofu dregs flour in the cone formulation. Agne *et al.* (2010) stated that betacyanin is stable at a pH of 4.5 but degrades with increasing pH. In the current research, the tofu dregs flour had a pH of 5.4, reducing the stability of betacyanin and the intensity of the red color produced. In contrast, a* increases with beetroot concentration in the extract, which positively correlates with the tuber's betacyanin content as the source of the red color.

b* values (yellowness)

b* represents yellow and blue: a positive value (+b*) corresponds to yellow, whereas a negative value (-b*) corresponds to blue (Prabowo *et al.*, 2013). Table 1 shows that b* values differed insignificantly between the flour ratios but significantly between the beetroot extract concentrations. Based on the positive b*, the cone's color was in the yellow region. However, because the a* values were consistently higher than b*, the red color produced by betacyanin dominated the cone.

Yields

Yield measures the weight of the final product in relation to raw materials and is expressed in percent. Table 1 shows that different flour ratios and beetroot extract concentrations produced significantly different yields. Yields tended to increase with the proportion of tofu dregs flour. According to Sudaryati *et al.* (2012), this correlates to the ability of the flour's crude fiber to bind water. In contrast, the table indicates an inverse relationship between yield and beetroot concentration, which might be caused by the baking process in making cones.

Moisture Content

Moisture content is the amount of water in the material and is expressed in percent. It is a factor that determines the length of time a food ingredient can be stored without losing suitability for use. Food with low moisture content can have a long shelf life (Winarno, 2002). Table 2 compares the

chemical properties of the cones. Significant differences in moisture content were identified between different flour ratios and beetroot extract concentrations. The higher the proportion of tofu dregs flour and the % beetroot extract, the higher the cone's moisture content. The table also shows that the water content varied from 5.92 ± 0.24 to $8.37 \pm 0.16\%$, which is higher than the maximum moisture content required in Indonesian National Standard SNI-2973-1992. The cone's high moisture can be attributed to raw material, processing technique, and crude fiber. According to the Directorate General of Public Health (2017), beetroot contains 87.6 g/100 g of water. Because the crude fiber in beetroots absorbs and binds strongly to water, the water contained in the product is difficult to evaporate even with heating (Sudaryati *et al.*, 2012). Therefore, the flour used in the formulation should be pre-roasted so as not to increase the cone's moisture content.

Ash Content

Ash is a combustion residue in the form of inorganic substances that is closely related to the presence of minerals in a material (Sudarmadji *et al.*, 1997). Table 2 shows

that the ash contents differed significantly between flour ratios but insignificantly between beetroot extract concentrations. Furthermore, it indicates positive correlations between the ash contents, the proportion of the tofu dregs flour, and the % beetroot extract. This can be linked to the ash content of the ingredients used: 1.62% in tofu dregs flour (Rusdi *et al.*, 2011), 0.62% in wheat flour (Murtini *et al.*, 2005), and 1.1 g/100 g in beetroots (Directorate General of Public Health, 2017). As presented in the table, the ash content ranged from 1.58 ± 0.42 to $2.53 \pm 0.08\%$, which exceeds the maximum requirement of 1.5% according to SNI-2973-1992. The cone's high ash content is due to inorganic residues in tofu dregs flour and beetroots (Fitriyani *et al.*, 2021).

Fat Content

Fat is a heat transfer medium and a source of calories that improves a product's texture and taste (Winarno, 2002). Table 2 shows that the fat contents differed significantly between flour ratios and beetroot extract concentrations. Moreover, the cone's fat increased with the proportion of tofu dregs flour in the formulation. The table shows that the fat content ranged from 17.11 ± 0.24

Table 2 Summary of the chemical analysis of ice cream cones made with wheat flour and tofu dregs flour at different ratios and beetroot extract at different concentrations

Wheat flour:tofu dregs flour ratio	% Beetroot extract	Chemical analysis					
		Water (%)	Ash (%)	Fat (%)	Protein (%)	Betacyanin (mg/100gr)	Crude fiber (%)
90:10	30%	5.92 ± 0.24^a	1.58 ± 0.42^a	17.11 ± 0.24^{ab}	12.44 ± 0.31^a	0.055 ± 0.012^{abcd}	7.59 ± 0.15^a
	40%	6.29 ± 0.04^{ab}	1.68 ± 0.19^{ab}	18.88 ± 0.24^c	12.18 ± 0.03^a	0.064 ± 0.011^{cd}	8.16 ± 0.11^b
	50%	6.11 ± 0.37^a	2.20 ± 0.18^{bcd}	17.38 ± 0.36^{ab}	12.35 ± 0.20^a	0.074 ± 0.008^d	7.73 ± 0.13^a
80:20	30%	6.79 ± 0.15^{bc}	1.79 ± 0.09^{abc}	17.19 ± 0.18^{ab}	12.36 ± 0.16^a	0.047 ± 0.003^{abc}	9.87 ± 0.11^c
	40%	7.41 ± 0.24^d	1.92 ± 0.02^{abc}	17.57 ± 0.46^b	13.16 ± 0.16^{bc}	0.054 ± 0.003^{abcd}	9.81 ± 0.19^c
	50%	8.37 ± 0.16^f	1.81 ± 0.38^{abc}	16.82 ± 0.19^a	13.43 ± 0.04^{cd}	0.059 ± 0.013^{bcd}	10.92 ± 0.02^d
70:30	30%	7.73 ± 0.21^{de}	2.53 ± 0.08^d	21.18 ± 0.34^e	13.55 ± 0.01^d	0.033 ± 0.006^a	12.88 ± 0.04^f
	40%	7.22 ± 0.09^{cd}	2.33 ± 0.10^{cd}	20.35 ± 0.31^d	13.46 ± 0.08^{cd}	0.040 ± 0.013^{ab}	12.05 ± 0.04^e
	50%	7.99 ± 0.30^{ef}	2.27 ± 0.22^{cd}	20.22 ± 0.28^d	13.06 ± 0.06^b	0.059 ± 0.003^{bcd}	13.87 ± 0.05^g

Notes: Values followed by the same letter are not significantly different from one another according to Duncan's test at a 5% significance level.

to $21.18 \pm 0.34\%$, which meets the minimum requirement of 9.5% set in SNI-2973-1992. These can be associated with the fat content of the ingredients used: 19.69% in tofu dregs flour (Sulaeman *et al.*, 2007), 0.92–1.49% in wheat flour (Murtini *et al.*, 2005), and 0.16% in beetroots (Abdo *et al.*, 2020). Also, margarine containing 81 g/100 g fat was used to grease the cone maker, adding to the product's fat.

Protein Content

Table 2 shows that different flour ratios produced significantly different protein contents, whereas beetroot extract concentrations gave an insignificant effect. The protein contents tended to increase with the addition of more parts of tofu dregs flour and beetroot extract concentrations to the dough. Ice cream cone formulations in this research produced protein contents in the range of 12.18–13.55%, higher than the protein found in commercial ice cream cones sold with the brand Superindo Sugar Cone, i.e., 1%. Based on SNI-2973-1992, the cone's protein levels meet the minimum requirement of 9.0%. Tofu dregs flour comes from soybean-based tofu, which is a source of vegetable protein of approximately 21.53% per 100 g (Suryani *et al.*, 2018). Besides, protein can also be found at 8.05% per 100 g in wheat flour (Suryani *et al.*, 2018) and 1.6 g per 100 g in beetroots (Directorate General of Public Health, 2017), which affect the protein content of the produced cones.

Betacyanin Content

Betacyanin is a red component in beetroot's pigment composition that can be used as a

natural dye. Nitrogen is responsible for betacyanin production and, thus, the beetroot's red color (Setiawan *et al.*, 2015). As seen in Table 2, betacyanin was found at concentrations that differed significantly between flour ratios and beetroot extract concentrations.

Increasing the proportion of tofu dregs flour in the dough lowers the betacyanin content because it creates a higher pH in which betacyanin is less stable (Herbach & Stintzing, 2004). The produced flour had a pH of 5.4. According to Agne *et al.* (2010), betacyanin is stable at a pH of 4.5 and degrades with increasing pH. This is caused by the chromophores that begin to shift and form a lighter color.

The higher the beetroot extract's concentration, the higher the cone's betacyanin content. Hanifan *et al.* (2016) explained that adding beetroot extract to gummy candy formulation substantially increases betalain to 1.356 mg/100 g. Betalain is composed of betacyanin (red pigment) and betaxanthin (yellow pigment) (Silalahi, 2018).

The ice cream cone was baked at $\pm 80^{\circ}\text{C}$. Heat is an influencing factor for the stability of betacyanin in this study. Heating can break bonds, decreasing betacyanin production and the intensity of the red color produced. Betacyanin is stable at room temperature and does not show notable changes until 60°C . Color changes can be observed at 80°C because betacyanin begins to degrade into cyclo-dopa 5- β -glycoside and betalamic acid; the latter has a bright yellow color (Agne *et al.*, 2010; Sari, 2018).

Crude Fiber Content

The crude fiber was measured to determine production efficiency and the purity of the ingredients used (Sudarmadji, 1997). Table 2 shows that the cones made with different flour ratios and beetroot extract concentrations had significantly different crude fiber contents. Adding more parts of tofu dregs flour and beetroot extract with higher concentrations tended to increase crude fiber. As summarized in the table, the crude fiber contents varied from 7.59 ± 0.15 to $13.87 \pm 0.05\%$, substantially higher than the maximum requirement of 0.5% laid in SNI-2973-1992. These results are related to the high crude fiber found in the ingredients: 15.29% in tofu dregs flour (Sudaryati *et al.*, 2012), 0.40–0.50% in wheat flour (Setyowati & Nisa, 2014), and 2.6 g per 100 g in beetroots (Directorate General of Public Health, 2017).

Color

Color is significant for product characterization in that it is the first attribute consumers see, and this perceptual construct determines their level of acceptance (Silalahi, 2018). Results show that more tofu dregs flour and beetroot extract in the cone formulation decreased color preference. The 90:10 wheat flour:tofu dregs flour ratio and 30% beetroot extract produced cones with an bright red color and interested for panelist, while the 70:30 flour ratio and 50% beetroot extract formed a dark color and not interested for panelist. This is caused by the flour's color and betacyanin in beetroots. Beetroots give beef sausages a red color but will produce a darker (more intense) color that is less

preferred by the panelists if added substantially (Winanti *et al.*, 2013). Furthermore, according to Sabir *et al.* (2020), tofu dregs flour is responsible for the dark color of crackers because it is browner than the commonly used wheat flour. In the color analysis, the 90:10 flour ratio and 30% beetroot extract produced an L^* (lightness) value of 43.65 and a^* (redness) value of 26.58, creating bright red cones with less intense colors than other formulations. Organoleptic testing based on product preference by panelists showed that these characteristics had the highest color preference (Table 3), with red density and brightness being the determining factors for the cone's acceptance.

Taste

In addition to color, taste is also an influencing factor in product acceptance. Taste is an attribute that involves a combination of tasting stimuli in the tongue (Winarno, 2004). The 90:10 flour ratio and 30% beetroot extract produced a slightly liked taste, while cones with the 70:30 flour ratio and 40% beetroot extract were disliked. More tofu dregs flour and beetroot extract in the formulation decreased taste preference. This result is consistent with Hanifan *et al.* (2016), which found lower acceptance of the taste of gummy candy made with a higher amount of beetroot extract. The distinctive earthy taste of beetroot is a result of geosmin from soil microorganisms (Lu *et al.*, 2003). Cones can be added with sugar and powdered milk to disguise this taste.

Aroma

Aroma is an attribute sensed through the nose and stimulated by olfactory nerves in the sense of smell (Negara *et al.*, 2016). The 80:20 flour ratio and 30% beetroot extract produced a slightly disliked aroma, while cones made with the 70:30 flour ratio and 40% beetroot extract were disliked. More tofu dregs flour and beetroot extract in the formulation decreased aroma preference. This finding corresponds to Sabir *et al.* (2020), which found that crackers made with a higher proportion of tofu dregs flour have lower acceptance. Lipoxxygenase is the enzyme that produces the typical sour and musty odor of soybeans, which can affect smell preference (Syafitri *et al.*, 2019). The same odor is believed to be responsible for the lower preference for cones made with a higher concentration of beetroot extract (Winanti *et al.*, 2013). Off-flavors or aroma irregularities can be improved by adding food additives like powdered milk.

Crispness

Crispness is a texture parameter related to a product's brittleness when exposed to a specific force or pressure (Viani, 2017). Cones made with the 80:20 flour ratio and 30% beetroot extract produced the crispness the panelists liked, while that of the 70:30 flour ratio and 50% beetroot extract were disliked. More tofu dregs flour and beetroot extract in the formulation decreased preference for the cone's crispness. Tofu dregs flour contains 15.29% crude fiber (Sudaryati *et al.*, 2012). In Sabir *et al.* (2020), a higher proportion of tofu dregs flour produces crackers with higher crude fiber and less disliked texture. The crude fiber in plant materials is made of complex compounds that are difficult to break down during processing, thus forming tissues with tightly bound cells and a hard or less crispy texture (Harijono *et al.*, 2001).

Table 3 Summary of the organoleptic testing of ice cream cones made with wheat flour, tofu dregs flour, and beetroot extract based on product preference with a five-point hedonic scale

Wheat flour:tofu dregs flour ratio	% Beetroot extract	Organoleptic analysis				
		Color	Taste	Aroma	Crispness	Overall preference
90:10	30%	3.74±0.91 ^a	3.86±0.78 ^a	3.60±0.66 ^a	4.19±0.95 ^a	4.04±0.94 ^a
	40%	2.97±0.95 ^b	3.14±0.88 ^b	3.38±0.78 ^a	2.26±0.99 ^b	2.85±0.93 ^b
	50%	2.06±0.87 ^{bc}	2.72±1.01 ^b	2.70±0.98 ^b	1.47±0.82 ^{bc}	2.19±0.86 ^{bc}
80:20	30%	3.53±1.14 ^{ab}	3.61±1.18 ^{ab}	3.78±0.77 ^a	4.32±0.75 ^a	4.07±1.00 ^a
	40%	3.73±1.22 ^a	2.90±0.91 ^b	3.36±0.80 ^a	2.66±1.21 ^b	2.97±1.28 ^b
	50%	2.42±0.89 ^b	2.87±0.88 ^b	2.96±0.69 ^{ab}	2.60±0.99 ^b	2.98±1.06 ^b
70:30	30%	2.81±0.99 ^b	2.66±0.96 ^b	2.58±0.86 ^b	1.65±0.87 ^{bc}	2.54±0.88 ^b
	40%	2.74±1.10 ^b	1.83±1.13 ^{bc}	1.81±0.98 ^{bc}	1.10±0.85 ^{bcd}	1.60±1.20 ^{bc}
	50%	1.67±0.87 ^{bc}	2.08±0.71 ^{bc}	2.03±0.94 ^{bc}	1.01±0.52 ^{bcd}	1.46±0.60 ^{bcd}

Notes: Values followed by the same letter are not significantly different from one another according to Duncan's test at a 5% significance level.

Overall Preferences

Overall preference is an attribute referring to the panelists' acceptance of a product based on its color, taste, texture, and appearance, which, according to Putri *et al.* (2022), is influenced by numerous factors. More tofu dregs flour and beetroot extract in the formulation decreased the overall liking for the cone. Color is the first attribute visible to consumers. The higher the tofu dregs flour and beetroot extract in the dough, the darker the cone's color and the lower the preference. The crude fiber in tofu dregs flour affects the product's texture; thus, when added in a higher amount, it results in higher crude fiber content and less crispy texture. The ingredients added to the wheat flour also affect the cone's taste and aroma. Therefore, food additives, i.e., powdered milk and sugar, were used in this research to disguise the distinctive earthy taste and aroma of beetroots and the sour and musty smell of tofu dregs flour.

CONCLUSION

Chemical analysis showed that with different ratios of wheat flour to tofu dregs flour and beetroot extract concentrations, the produced cones have different nutritional components and organoleptic properties. The 70:30 flour ratio and 30% beetroot extract produce cones with 13.55% protein, while the ones made with the 90:10 flour ratio and 50% beetroot extract contain 0.074 mg/100 g betacyanin. Based on organoleptic characteristics, the most preferred cones by the panelists are formulated with the 80:20 flour ratio and 30% beetroot extract. Product

preference analysis using the hedonic scale revealed that the panelists slightly like the cone's color (3.53), taste (3.61), and aroma (3.78) and like the crispness (4.32), resulting in an overall preference of 4.07 (like). It is suggested that further research improves the formulation to meet the Indonesian National Standard (SNI), especially the requirements for moisture, ash, and crude fiber contents in the final product. Also, it is necessary to refine the resulting thickness to create cones with a good texture.

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