

Sensory Evaluation and Application of Ginger- And Lemon-Flavored Kropek: Effects on Consumer Acceptability and Shelf Life

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ABSTRACT

Ginger and lemon are known for their flavor and nutritional value, thus there is promising opportunity for food product innovation. In this study, the sensory characteristics and acceptability of ginger- and lemon-flavored kropek with varying ingredients ratios. A repeated measures design was used, involving 35 students from Buenavista Community College who evaluated three treatments (T1, T2, T3) using a 5-point hedonic scale for appearance, aroma, taste, and texture. to determine the acceptability of three kropek treatments with increasing levels of ginger and lemon (T1, T2, T3) among 35 students of Buenavista Community College. A 5-point hedonic scale recorded appearance, aroma, taste, and texture. Data were analyzed by weighted mean determination and by Friedman's test. Findings revealed that Treatment 1, with the highest amount of ginger and lemon, was most preferred across all sensory attributes but incurred the highest cost of production. Sun drying was found to extend shelf life but reduced product quality. The very marked significance differences in consumer preferences likeness across treatments highlights the impact of ingredient ratios on consumer perception. These results indicate suggest that ginger lemon flavored kropek can be a very is a promising product. Further research should focus on cost-effective production methods, improve and optimal drying techniques, as and a deeper understanding of well as on consumer preferences to optimized product development.

Keywords: Ginger, Lemon, Kropek, Sensory Evaluation, Friedman Test, Product Development

INTRODUCTION

Ginger-lemon combines the perfect proportion of spicy and citrusy flavors with great taste and added nutritional benefit. It meets the ever-growing, health-conscious consumer demand and offers compelling refreshing taste profiles. Ginger helps in weight loss by suppressing hunger, while lemon is rich in vitamin C and a number of other vitamins besides several antioxidants, helpful for boosting the immune system (WebMD Editorial Contributor, 2023). Several industrial revolutions catalyzed the wave of modernization, setting a fertile ground for new and inventive products. Food snacks, such as Kropek—a favorite Filipino snack among kids and adults alike—show this very phenomenon. Kropek is differentiated into crops, fruits, and seafood and vegetable types, but it essentially becomes a starch or tapioca flour-based food source.

The acceptability of Ginger lemon-flavored Kropek can be understood based on theoretical and legislative standpoints. According to Innovation Theory, as Schumpeter opined in 1932 and which Rabadán et al. shared in 2021, one of the key drivers for the success of an innovative product would be through its novelty, uniqueness, and relevance to fast-changing consumer preferences. By adding a new flavor to the traditional Kropek, a Ginger lemon flavor, the theory would allow for a new twinning of flavors on this particular snack food item. This will more than likely work better on contemporary tastes and thus will work more strongly in the market.

This innovation is supported by Food Pairing Theory, first introduced by Heston Blumenthal and François Benzi in 2002 and cited by Sofer in 2024. The theory inquiries into how the particular combination of flavors can elevate the total sensory experience of a dish. According to this theory, some ingredients, like ginger and lemon, make a more harmonious and pleasing taste profile since they combine to create a more natural taste. Applying this theory to Kropek, the ginger and lemon mixture will improve its flavor profile, hence more attractive to consumers who need new and balanced taste experiences. This strategy not only substantiates the theory but also

gives a strategic advantage in differentiating the product from the traditional variants, hence attracting a larger market share due to the new and pleasing flavor combination.

Legislative frameworks further provide a supportive system for food innovations and guide them toward national priorities and standards. Article XIV, Section 10 of the 1987 Philippine Constitution reminds one to develop resources to sustain national development, specifically in relation to the sourcing of ingredients from local sources, such as ginger and lemons. This is the provision that encourages sustainable agriculture for the benefit of local farmers and to enhance food quality. In promoting local ingredients, it serves the larger goal of supporting local industries to contribute to national economic growth. Such an approach does not only sustain local agriculture but also the feeling of community and sustainability in food production.

Adding to the promotion of resource efficiency, Article 2, Section 15 of the 1987 Philippine Constitution also emphasizes the state's responsibility for protecting public health and ensuring confidence in the food regulatory system. It has been stressed that this regulatory oversight on the entry of new food products, specifically the ginger lemon flavored Kropék, into the market shall make sure to avoid health risks among consumers by complying with set safety standards. This section shall support stringent food safety to facilitate the development and market launch of new foods that shall also be safe. Public health and regulatory trust are keys to the acceptance by consumers and to a successful market launch of novel food products.

Consumer protection is mostly assured by Republic Act No. 7394, known as the "Consumer Act of the Philippines," which provides for strict business practice standards that generally require products to truly suit consumer expectations and quality standards. With this act, food products like the innovative snack Ginger lemon-flavored Kropék will have assurances of development with consumer protection and satisfaction in mind. This legislation also builds trust among consumers and facilitates fairness in the marketplace by clearly specifying the guidelines on product quality and business ethics. It would, therefore, be necessary for the provisions under this act to ensure a friendly consumer environment for the new products.

Protection against hazardous products and trade malpractices is mandated in Section 9 of Article XVI of the 1987 Philippine Constitution, thereby strengthening the implications for safety in food innovations. This section makes sure that food innovations are regulated in relation to strict safety regulations so that consumers may be able to avoid health risks that are associated with some other uncontrolled or unsafe products. Protection against trade malpractices is essential for the integrity of the food industry, and for maintaining consumer confidence. The innovative products, such as the ginger lemon-flavored Kropék, should guarantee the passage of safety standards in order to be successfully introduced and accepted within the market.

Another law that provides for a more solid base of food safety regulations is Republic Act No. 10611, also known as the "Food Safety Act of 2013." It forms comprehensive standards for the safety of food products and is essentially important to ensure that food innovations like Ginger lemon-flavored Kropék do not just attain an innovative level but also abide by very stringent safety requirements. This legislation has advanced regulatory control and oversight of safety practices from the production phase all the way through to the consumption of food products. It reinforced food safety practice that helps to yield safe, market-ready products and reduces the potential risk of health complications.

Food acceptance is related to complex problems of sensory experiences and consumer expectations. According to Meiselman, 2023, food acceptability entailing sensory characteristics, taste, odor, and texture associated with unique consumer preferences, can make or break a food product in the market. Concerning ginger lemon flavor Kropék, its success will depend on how well the product fits the consumers' expectations of such sensory qualities. Unless the product can deliver a satisfying sensory experience that matches or beats consumer anticipation, acceptance and popularity are unlikely.

In support of this, Larina (2017) argues that innovation entails the creation and application of new ideas aimed at improving products. Devising new flavors, such as Ginger lemon, for Kropék is an example of innovation in attempts to make the product more appealing. Characterized by a new, different flavor, this approach is tailored to suit the changing tastes and preferences of buyers. It can, therefore, help the product differentiate in a competitive market and attract a larger consumer base by the integration of innovative flavors.

The addition of ginger greatly raises the nutritional value of Kropek, considering its well-documented pharmacological effects, which include being an antioxidant and antidiabetic drug (Bekkouch et al., 2022). This serves to appeal to the emerging customer need for health-sensitive snacks and places Kropek as one offering functional food with more than just taste. Lemons add a high content of vitamin C to the snack and associated health benefits, therefore enhancing the nutritional value of the snack (Merano, 2018). The mixture of such healthful ingredients in Kropek enables both a special flavor and supports general well-being, thereby aligning the product with contemporary dietary trends oriented toward health and wellness.

Ginger (*Zingiber officinale Roscoe*) contains a multitude of bioactive compounds, including phenolic compounds, terpenes, polysaccharides, lipids, organic acids, and raw fibers (Mao et al., 2019). The bioactive compounds are responsible for ginger's extensively documented medicinal uses, including its anti-inflammatory, antimicrobial, and digestive uses, and its popularity as a common ingredient in traditional and conventional medicine, especially in treating gastrointestinal discomfort and gut health. Conversely, *Citrus limon* boasts high levels of health-augmenting characteristics, with particular anti-cancer and antioxidant activity, and is increasingly utilized in food cultivation and cosmetology (Klimek-Szczykutowicz et al., 2020). The fact that it contains large amounts of vitamin C, flavonoids, and essential oils improves its antioxidant ability, thereby counteracting free radicals, boosting the health of skin, and curbing the incidence of disease. Historically, the ginger and lemon combination has been used to calm the digestive system, ease the stomach, and ease mild nausea, as well as being known for its ability to boost the immune system (Healthieries Hub, 2020). Besides all this, Al-Ataby and Talib (2021) have discovered that the combination of lemon and ginger is a promising candidate for use in the creation of anticancer infusions to complement traditional anticancer treatments. Their synergistic qualities make an effective natural medicine that stimulates digestion, supports immunity, and promotes detoxification, such that ginger and lemon are highly sought after by health-oriented consumers as ingredients for herbal teas, tonics, and nutritional supplements.

Healthy ingredients such as these resonate with today's consumers looking both for innovation in their snacks and goodness for their total well-being. The rising trend of healthy eating has presented a market opportunity for foods that offer something more than excellent taste, serving the people who value good nutrition and well-being. Kropek, in the meantime, offers a healthy content of carbohydrates and protein, minute traces of vitamins and micronutrients, dietary fibers beneficial for digestive well-being, microbial flora, blood cholesterol, glycemic index, and diabetes management (Ostonal et al., 2020). But the difficulty is in creating new-age snacks, like ginger lemon-flavored Kropek, that not only appeal to conventional taste buds but also stand out in a highly competitive market. Finding the perfect balance between newness and familiarity is key to attracting health-oriented consumers who are looking for products that complement their lifestyles without sacrificing taste.

Being one of the most famous snacks in Asia, Kropek inherently has a history and has quite fittingly been taken into the Asian fusion scene, reflecting deep cultural roots and adaptability (Estrella, 2022). This age-long tradition underlines the already established presence of Kropek in the market and simultaneously shows its potential for evolution according to consumer preference. Although consumers are gradually becoming more open to new foods, striking a balance between such innovations and existing traditional food preferences remains challenging (Editorial Contributor, 2023; Sajdakowska, 2018). Innovative flavor variations, like ginger-lemon flavored Kropek, are quite promising; how far it would succeed depends on how far the traditional flavor is respected, yet bringing novelty capable of meeting the expectation of the modern consumer.

Larina, 2018 pointed out that fast product turnover and a high demand for new food products is what forces businesses to keep innovating and change under the influence of market dictates. At this pace, it is possible to come up with new products, but the trickier part is to ensure that these innovations appeal to the customer, who is changed-wary. Successful products often make it into the marketplace with unique attributes that differentiate them from the competition while still satisfying the core preferences of traditionalists. Ginger lemon-flavored Kropek must be both appealing to adventurous consumers and those who like more conventional options to strike a balance between innovation and tradition in the snack market. In a 2022 study, Fletcher examined ginger for its potential to create intestinal gas, which may have an impact on digestion and alleviate gastrointestinal discomfort. This additional digestive benefit enhances the health benefits that can be gained from the inclusion of ginger in food products such as Kropek. Improving digestive health with ginger not only offers general health value to the consumer but also links the ingredient to consumer demand for functional foods offering specific

health benefits. This is an aspect of ginger that makes Kropek more exciting to health-conscious consumers seeking better digestive health through their diet.

New flavor combinations are effective at arousing consumers' interest and curiosity, according to studies like Fischer & Reinders (2022) and Ostonal et al. (2021). This is highly significant to the success of a novel product like Kropek with a ginger lemon flavor. Unique flavor profiles can consequently individualize products within a very competitive market and attract consumers who are always on their toes trying to experience new tastes. This penchant for consumer engagement is what underlines the importance of innovation in capturing attention and driving product success. With the help of new flavors, ginger lemon-flavored Kropek should be well on its way to dominating snack food markets.

This makes a huge difference not only in flavor innovation but also in the quality characteristics of Kropek, like crispiness, in consumer acceptance and overall satisfaction. Beatz identifies the crispiness of Kropek as one of the key quality measures in 2016. He said that texture is a critical factor in setting consumer preference. Therefore, maintaining a crisp texture in ginger lemon-flavored Kropek will be important in ensuring consumer expectations and entrenching the overall product experience. This texture focus, combined with original flavors, can make a snack more attractive and marketable.

Liivat (2023) further argued that food innovation remained the key driver of industry productivity and market choices, quite important in the changing landscape for food. In a general point of view, food innovation may help not only in introducing new products to consumer markets but in the growth and adaptability of industries altogether. Businesses are, therefore, embracing innovative approaches by way of the introduction of Ginger lemon-flavored Kropek to remain competitive and responsive to the changing consumer market. Effective innovation strategies can thus be a means of gaining market share and providing the basis for long-term industrial success, therefore becoming a necessity for remaining competitive in a dynamic market environment.

Keeping in mind the foregoing, although no published research specifically tackles Ginger lemon-flavored Kropek, its sensory attributes seem very promising for this novel snack. The incorporation of ginger and lemon, basically available in the locality, particularly in Bohol, with these ingredients specifically known as "luya" and "lemon," respectively, supports the innovation up with a different and more healthful flavor. This combination makes use of local resources and health benefits that would be in compliance with the modern consumer demand for a healthy, innovative food product. One of the potentially successful combinations to be added to the market, taking advantage of the healthy properties of ginger and lemon while making a balance between innovation and traditional preferences, will be ginger lemon-flavored Kropek. It is not only responsive to changing taste but also develops local agriculture, hence giving a complete opportunity for consumer reach-out and market growth.

METHODOLOGY

The researchers employed a Repeated Measures design also known as within-groups or within-subjects design. Repeated Measures design is an experimental design where the same participants participate in each independent variable condition (McLeod, 2023). This kind of design guarantees that each experimental condition includes exactly the same group of participants to enhance reliability. Moreover, simple random sampling was used in choosing the participants, hence ascertaining that the sample used in the research is in no way biased. The testing of the products was tried out by thirty-five Buenavista Community College students who tested the product for the experiment.

A 5-Point Hedonic Scale was utilized to assess the acceptability of Ginger and Lemon flavored Kropek (*Zingiber officinale* Roscoe and *Citrus limon*) in terms of appearance, aroma, taste, and texture, facilitating data collection among respondents (Graham et al., 2017). The product was rated on a scale from 5, "Like Extremely," to 1, "Dislike Extremely," using a structured questionnaire, allowing for the effective capture of respondents' subjective evaluations, preferences, and perceptions. Additionally, a Unipolar Scale was employed to measure the sensory characteristics of Ginger Lemon flavored Kropek, with response options ranging from 1, "Not at all appealing," to 5, "Extremely appealing." Unipolar Scales measure the intensity of a feeling or opinion, providing a clear and focused assessment of how appealing the product's sensory attributes are to consumers (SurveyMars, 2024).

Analysis of the data for likeability of the three treatments with respect to appearance, aroma, taste, and texture was done through the weighted mean formula. Friedman's Test was performed to determine the most acceptable treatment of the ginger lemon flavored kropek. In this way, these statistical methods facilitated a full assessment of product acceptability and thus brought out the highest-rated aspects and general preferences from the participants.

RESULTS AND DISCUSSION

The results, analysis, and interpretations of the data collected using a questionnaire and the descriptive survey method are presented here.

Table 1. Ingredients and Costs of Ginger Lemon Flavored Kropek in Three (3) Treatments

Description of Ingredients	Quantity			Unit	Unit Cost	Total Cost		
	T1	T2	T3			T1	T2	T3
Ginger	240	148	118	ml	97.50	23.40	14.43	11.50
Lemon	240	148	118	ml	360.00	86.40	53.28	42.48
Tapioca Flour	1.27	1.27	1.27	cup	420.00	35.00	35.00	35.00
Sugar	3	3	3	tbsp	45.45	3.81	3.81	3.81
Chili Powder	2	2	2	tbsp	80.55	22.55	22.55	22.55
Garlic Powder	1	1	1	tbsp	38.40	6.40	6.40	6.40
White Pepper	1	1	1	tbsp	35.10	3.90	3.90	3.90
Hot Water	1	1	1	cup	1.00	1.00	1.00	1.00
Salt	1/2	1/2	1/2	tbsp	5.70	1.90	1.90	1.90
Oil	375	375	375	ml	40.00	13.33	13.33	13.33
TOTAL COST						197.69	155.6	141.87

Table 1 shows the ingredients and production cost of Ginger Lemon Flavored Kropek in three treatments (T1, T2, and T3). The table identifies the difference in the amount of ingredients and their contribution to the total cost of each formulation. Of particular note is that the main difference among the three treatments is the level of ginger and lemon used. T1 has the highest levels of ginger and lemon at 240 ml each, while T2 and T3 have 148 ml and 118 ml, respectively. As the unit costs for these ingredients are high—97.50 per ml for ginger and 360.00 per ml for lemon—their amounts significantly reduced keep the overall production cost in T2 and T3 low. The other ingredients, including tapioca flour, sugar, chili powder, garlic powder, white pepper, hot water, salt, and oil, are used consistently in all the treatments.

Tapioca flour, whose unit cost is 420.00 per cup, adds a fixed amount of 35.00 to each treatment and hence forms one of the significant cost elements. Oil, which is utilized at a uniform 375 ml in all treatments, adds a fixed overall cost of 13.33 per formulation. These constant ingredient amounts show that total cost variability is largely the result of variations in ginger and lemon amounts. Of the three treatments, T1 has the greatest total cost at 197.69 with its higher levels of ginger and lemon, whereas T2 with lesser amounts has a moderate total cost of 155.60. T3, with the smallest quantity of ginger and lemon, has the lowest overall cost at 141.87. The differences in costs imply that lowering the amount of these principal flavoring agents makes Kropek production more cost-

effective. Still, lowering the ginger and lemon might also affect the sensory aspects of the product, such as its smell, flavor, and general attractiveness. The difficulty is in achieving a balance between cost-effectiveness and consumer acceptability, so that the product is both palatable and cost-effective. An understanding of these cost differences can help in establishing the most effective formulation that is acceptable to consumers and yet profitable.

Table 2. Tools and Equipment Used In Ginger Lemon Flavored Kropek

Tools and Equipment	Quantity	Unit
Measuring cup and spoon	1	Set
Frying pan	1	Pc
Drying Tray	1	Pc
Strainer	1	Pc
Steamer	1	Pc
Kitchen knife	1	Pc
Chopping Board	1	Pc
Gas Stove	1	Unit
Food Weighing Scale	1	Unit
Turbo Blender	1	Unit

Table 3. Shelf-Life of Ginger Lemon Flavored Kropek

	Treatment 1		Treatment 2		Treatment 3	
	Without Drying un- der the Sun	Drying un- der the sun	Without Drying un- der the Sun	Drying un- der the sun	Without Dry- ing under the Sun	Drying un- der the sun
Observation for 0 – 5 days	No Change of appear- ance, aroma, taste and tex- ture	No Change of appear- ance, aroma, taste and tex- ture	No Change of appear- ance, aroma, taste and tex- ture.	No Change of appear- ance, aroma, taste and tex- ture	No Change of appearance, aroma, taste and texture	No Change of appear- ance, aroma, taste and tex- ture
Observation for 5 – 10 days	Started los- ing crishi- ness	Texture be- came less crispy	Started los- ing crishi- ness	Texture be- came less crispy	Started losing crispiness	Texture be- came less crispy
Observation for 10 – 15 days	Totally lost of texture and aroma	Color changed, less crispy, be- came tough	Totally loss of texture and aroma	Color changed, less crispy, be- came tough	Totally loss of texture and aroma	Color changed, less crispy, be- came tough

Table 2 shows 9 Tools and equipment to be used in making ginger lemon-flavored kropek Tools and Equipment Quantity Unit Measuring cups and spoons frying-pan drying tray strainer steamer kitchen knife chopping board

gas stove food weighing scale turbo blender. Quantity is always one, and units are specified for each item. Actually, processing Ginger Lemon Flavored Krokot is a bit complex, right from the preparation and extraction of ginger and lemon up to the final frying stage. The procedure sees to it that everything is done with precision in attaining desired consistency and flavor. This shall result in a crispy and full-of-flavor krokot snack that balances innovation with traditional taste preference through the careful blending, kneading, steaming, slicing, drying, and frying of ingredients. It would help not only meet current consumer requirements with regard to healthier and more innovative snacks but also give due emphasis to careful preparation and detailed execution of the same in food production.

Procedure

Step 1: Getting ready

1. Gather all the materials, ingredients, and tools needed for preparing the recipe.
2. Ready a clean, neat workspace to become efficient during preparation.

Step 2: Extract Ginger and Lemon Juice

1. Peel the ginger with a kitchen knife and chop small peeled ginger so that they blend easily.
2. Chop the lemon in half. Squeezed out the juice while removing the seeds.
3. Chopped ginger and lemon juice in the turbo blender to puree.
4. Strain with the help of a strainer, ginger-lemon extract from the pulp. The liquid extract is kept in a bowl.

Step 3: Blend Ingredients

1. Mix all the ingredients in one big bowl. Add in it 300 grams of tapioca starch/flour. Add ginger-lemon extract, 1 tablespoon of garlic powder, half a teaspoon of salt, 1 tablespoon of chili powder, and 1 tablespoon of white pepper in it.
2. Start adding 1 cup hot water gradually in it slowly. Continue stirring until the batter's uniform.
3. Pour it on a clean surface or large bowl.
4. Knead for some time till the dough turns to be perfect. Dough should not be too sticky. It should be smooth and pliable.

Step 4: Steaming

1. Fill the steamer with water. Let it boil.
2. In a parchment-lined steamer basket, place the dough. Steam for 1 to 2 hours or until the dough is firm and cooked.
3. Remove the steamed dough from the steamer and let it cool for some time.
4. Let the dough turn to room temperature before keeping it in the fridge for overnight. This step firms up the mixture so that it is easier to slice.

Step 5: Slicing

1. Remove the chilled dough from the fridge.
2. Divide the dough into small pieces of equal sizes using a kitchen knife and chopping board.

Step 6: Drying

1. Place the sliced dough pieces in the drying tray, leaving room between them so they don't overlap.
2. Take the tray outside directly under the sun and keep it there for 2 days. The slices should be turned from time to time to enhance perfect drying.
3. Slices ought to be super dry and brittle before proceeding.

Step 7: Frying

1. Fill a frying pan with 1000 mL of oil. Heat over medium heat. Check the temperature with a food thermometer, it should have reached around ~350°F or ~175°C.
2. Fry the kropek slices one by one in hot oil until crispy and golden brown. Take out using a slotted spoon, then drain excess oil through a strainer or with paper towels.
3. Then chill the fried kropek. Serve as a crunchy and full-of-flavor snack.

Table 3 shows the result of the experiment of shelf life of ginger lemon flavored kropek in various ways of drying. According to the table, kropek that is stored without drying under the sun, it maintained its appearance, aroma, taste, and texture for 0-5 days, started losing crispiness after 5-10 days, and completely loses its texture and aroma after 10-

15 days. In contrast, the sun-dried kropek looked, smelled, and tasted the same for 0-5 days, but it was less crispy in texture after 5-10 days and tough after 10-15 days. The sun-dried kropek also had a change in color and the crispiness was gone after 10-15 days.

Table 4. Level of Likeability of Ginger Lemon

Sensory Attributes	Treatment 1		Treatment 2		Treatment 3	
	WM	Description	WM	Description	WM	Description
Appearance	4.28	Like Extremely	3.74	Like Slightly	3.14	Neither Like or Dislike
Aroma	4.34	Like Extremely	4.00	Like Slightly	2.91	Neither Like or Dislike
Taste	4.57	Like Extremely	4.02	Like Slightly	3.48	Like Slightly
Texture	4.08	Like Slightly	3.74	Like Slightly	3.11	Neither Like or Dislike
Average Weighted Mean	4.31	Like Extremely	3.87	Like Slightly	3.16	Neither Like or Dislike

(*Zinger Officinale Roscoe* and *Citrus limon*) FLAVORED KROPEK

Scale:

4.20- 5.00 - Like Extremely

3.40- 4.19 - Like Slightly

2.60-3.39 - Neither Like or Dislike

1.80- 2.59 - Dislike Slightly

1.00-1.79 - Dislike Extremely

Based on the findings on Table 4, it can be concluded that Treatment 1 has a high rating for each sensory attribute—appearance, aroma, taste, and texture—with a mean score of 4.31, classifying it as "Like Extremely." This high level of likeability suggests that Treatment 1 is in line with customer preferences and meets expectations.

With an average score of 3.87, Treatment 2 was deemed to be likable on a medium level. Although it was favorably received by the customer, it did not satisfy their desire for something better. The average score for Treatment 3, on the other hand, was 3.16, indicating a neutral degree of likeability. With the exception of taste, which received a "Like Slightly" rating, other sensory qualities were rated as "Neither Like nor Dislike," indicating that consumers did not have many strong preferences.

These results demonstrate how important likeability is to consumers' acceptance of food goods. The formulation that had the best chance of winning over customers was Treatment 1, whereas Treatments 2 and 3 clearly needed improvement to become more likable. Ultimately, the results show that Treatment 1 is the best choice for this assessment since it satisfies the consumer's needs for sensory aspects.

Table 5. Sensory Characteristics of Ginger Lemon (*Zinger Officinale Roscoe* and *Citrus Limon*) Flavored Krokpek

Sensory Attributes	Treatment 1		Treatment 2		Treatment 3	
	WM	Description	WM	Description	WM	Description
Appearance	4.28	Extremely Appealing	3.74	Very Appealing	3.14	Moderately Appealing
Aroma	4.34	Extremely Appealing	4.00	Very Appealing	2.91	Moderately Appealing
Taste	4.57	Extremely Appealing	4.02	Very Appealing	3.48	Very Appealing
Texture	4.08	Very Appealing	3.74	Very Appealing	3.11	Moderately Appealing
Average Weighted Mean	4.31	Extremely Appealing	3.87	Very Appealing	3.16	Moderately Appealing

Scale:

4.20- 5.00 - Extremely Appealing

3.40- 4.19 - Very Appealing

2.60- 3.39 - Moderately Appealing

1.80- 2.59 - Slightly Appealing

1.00-1.79 - Not Appealing at All

Table 5 displays the results of the sensory evaluation of ginger lemon-flavored krokpek versus three distinct treatments, each of which included characteristics related to appearance, aroma, taste, and texture. Given that Treatment 1 scored highly in each of those criteria, it appears to be the most effective treatment. The overall rating for Treatment 1 was "Extremely Appealing" with WMs of 4.28 for appearance, 4.34 for aroma, 4.57 for

taste, and 4.08 for texture. This demonstrated that the most appealing, delicious, and aromatic treatment had a pleasing texture.

With an overall WM score of 3.87, Treatment 2 also performed quite well and, in a way, falls further into the "Very Appealing" group. Compared to Treatment 1, it had not gotten as many positive reviews. It did, however, receive above-average ratings for flavor (WM of 4.02) and aroma (WM of 4.00), indicating that it still possesses great sensory qualities. The average WM for Treatment 3 was as low as 3.16, placing it in the "Moderately Appealing" category. In contrast, all of the qualities in this treatment received low ratings. Its overall lesser appeal was also influenced by its comparatively lower scores in appearance and aroma.

In conclusion, based on these findings, Treatment 1 might be recommended as the ideal formulation to offer a very alluring sensory experience for kropek with a ginger lemon flavor. than put it another way, the assessors thought that Treatment 1 was superior than the other treatments in terms of appearance, taste, smell, and texture. Therefore, the formulation of Treatment 1 should be used if someone wished to manufacture ginger lemon-flavored kropek that people would love the most.

Table 6. Significance Difference on the Level of Likeness among the Three Treatments of Ginger Lemon-Flavored Kropek

Source	df	Fr Computed Value	p value	Decision
Ginger Lemon Flavored Kropek	2	8	5.99	Reject Ho

The presented Table 7 gives the results of a Friedman test that has been carried out in determining the level of likeness among three treatments of ginger lemon-flavored kropek, which are 240 ml, 148 ml, and 118 ml. A Friedman test has shown the treatment to be significantly different in the level of likeness at a p-value of 0.05. This means that at least one of the treatments may be taken as being different from the rest.

CONCLUSION

Development of the ginger lemon-flavored Kropek is an immense potential for a unique and profitable product. The reduction in ginger and lemon quantities can result in lowering costs in production; however, consumer preference is much stronger on the formulation with increased ginger and lemon. This also focuses on the issue of balancing cost efficiency against the appeal of the product.

In terms of shelf-life optimization, alternative drying techniques should be considered in order not to affect the quality of the product. Clearly, consumer perception differed across the three treatments and proves the existence of interactions among ingredients. Balancing consumer preference and cost will be key to the success of this product.

The findings provide a sound basis for further optimization of the production process of Ginger Lemon Flavor Kropek. Research on further consumer preferences and cost-friendly drying techniques, and even more innovative packaging techniques, could be matched with this to maximize the product's market potential.

APPENDIX

Ginger Lemon Kropek Recipe

A. Ingredients

- 8 oz Ginger (fresh)
- 4 oz Lemon (fresh)

- 300 grams Tapioca Starch/Flour
- 1 tbsp Garlic Powder
- ½ tsp Salt
- 1 tbsp Chili Powder
- 1 tbsp White Pepper
- 1 cup Hot Water
- 1000 ml Oil (for frying)

B. Tools and Equipment

- Measuring Cup and Spoon
- Frying Pan
- Drying Tray
- Strainer
- Steamer
- Kitchen Knife
- Chopping Board
- Gas Stove
- Food Weighing Scale
- Turbo Blender
- Parchment Paper

C. Procedure

Step 1: Getting ready

1. Gather all the materials, ingredients, and tools needed for preparing the recipe.
2. Ready a clean, neat workspace to become efficient during preparation.

Step 2: Extract Ginger and Lemon Juice

1. Peel the ginger with a kitchen knife and chop small peeled ginger so that they blend easily.
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3. Chopped ginger and lemon juice in the turbo blender to puree.
4. Strain with the help of a strainer, ginger-lemon extract from the pulp. The liquid extract is kept in a bowl.

Step 3: Blend Ingredients

1. Mix all the ingredients in one big bowl. Add in it 300 grams of tapioca starch/flour. Add ginger-lemon extract, 1 tablespoon of garlic powder, half a teaspoon of salt, 1 tablespoon of chili powder, and 1 tablespoon of white pepper in it.
2. Start adding 1 cup hot water gradually in it slowly. Continue stirring until the batter's uniform.
3. Pour it on a clean surface or large bowl.
4. Knead for some time till the dough turns to be perfect. Dough should not be too sticky. It should be smooth and pliable.

Step 4: Steaming

1. Fill the steamer with water. Let it boil.
2. In a parchment-lined steamer basket, place the dough. Steam for 1 to 2 hours or until the dough is firm and cooked.
3. Remove the steamed dough from the steamer and let it cool for some time.
4. Let the dough turn to room temperature before keeping it in the fridge for overnight. This step firms up the mixture so that it is easier to slice.

Step 5: Slicing

1. Remove the chilled dough from the fridge.
2. Divide the dough into small pieces of equal sizes using a kitchen knife and chopping board.

Step 6: Drying

1. Place the sliced dough pieces in the drying tray, leaving room between them so they don't overlap.
2. Take the tray outside directly under the sun and keep it there for 2 days. The slices should be turned from time to time to enhance perfect drying.
3. Slices ought to be super dry and brittle before proceeding.

Step 7: Frying

1. Fill a frying pan with 1000 mL of oil. Heat over medium heat. Check the temperature with a food thermometer, it should have reached around ~350°F or ~175°C.
2. Fry the kropek slices one by one in hot oil until crispy and golden brown. Take out using a slotted spoon, then drain excess oil through a strainer or with paper towels.
3. Then chill the fried kropek. Serve as a crunchy and full-of-flavor snack.

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