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Experimental Design Sensory Quality Boba Developed From Pumpkin

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ABSTRACT

In this day and age, boba topping is one of the most popular toppings for selling drinks, especially bubble tea. The boba itself was discovered in 1987 in Taiwan but has only recently become popular. Researchers want to make innovations from boba by adding pumpkin as the main ingredient of boba. Pumpkin has many benefits, so it is excellent and safe to use as a topping. In this study, researchers wanted to know about the original boba's color, taste, texture, and aroma, which would change if the essential pumpkin ingredient was added. This research is experimental. The researcher used an organoleptic test consisting of a hedonic test and a hedonic quality test to determine the panelists' preferences and good and bad impressions of the boba made. The researcher distributed the product to 20 trained panelists to be given an assessment. The results showed that the comparison of preferences between authentic boba and boba using pumpkin as the primary ingredient was not much different. The products made are still favored by the panelists. There are also some significant changes to the boba in color, taste, texture, and aroma.

Keywords: Boba; pumpkin; hedonic test; hedonic quality test, experiment design

JEL Classification: O32, Z30, Z39.

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INTRODUCTION

Boba originates from Taiwan and is known as *zenzhunaicha*. It is usually added to juices, iced tea, and drinks. In some outlets, boba is a portion of food for ramen and cakes. The chewy taste of boba is the main attraction for fans of sweet drinks. The main ingredient of boba is tapioca flour, which has no taste. The sweet taste of boba comes from the sugar or honey. Boba or bubble is a slang word in Mandarin. Boba is made from tapioca flour or cassava. In ancient times, Chinese immigrants who came to Taiwan set up teahouses to serve cold tea by putting tapioca balls into the drink. Boba has also spread to European countries. China offers instant boba milk tea, which we can store stock at home and brew when cold (Tinambunan, Syahra, & Hasibuan, 2020).

Since 2018, boba has become one of the public's most sought-after and favored toppings. Boba is a topping frequently added to drinks to give a more delicious taste and a strong flavor. Boba is suitable as a topping as it has a distinctive and unique taste and is one of the popular toppings. Researchers chose to design an experiment on sensory quality boba because we wanted to innovate from existing products and there is a large market selling boba with many enthusiasts. Fröjdö, (2018) stated that bubble tea was invented in 1986 when tea house owner Tu Tsong-He was inspired by the white tapioca boba seen at Ya Mu Liao market. He made tea using white tapioca balls into a black version mixed with brown sugar (Pangkey, Lapian, & Tumewu, 2016). The word boba originally came from a shaken drink to form a bubble, which later became the idea to make a delicious consumption topping. Most boba is made using palm sugar to create a sweet taste suitable for today's trendy drinks.

Boba, made from tapioca flour, and palm sugar, has no nutrition. We wanted to produce boba with a distinctive taste and a mix of ingredients rich in vitamins and other nutrients. We researched two ingredients that were equally suitable as essential ingredients: several types of tubers and pumpkin. Tubers have excellent nutritional content for the human body because they are rich in vitamins, carbohydrates, minerals, protein, iron, and calcium. Pumpkin contains starch, water, vitamins, and carbohydrates. From this comparison, we finally chose pumpkin as it contains starch, increasing the water holding capacity, making the boba more supple (Boediono, 2012; Zulaidah, 2012). Likewise, *Wayang Kuning* is a fruit originating from America brought to Indonesia in the 19th century. Pumpkin consists of three types: Cucurbita Pepo, Cucurbita moschata, and Cucurbita maxima. Pumpkins easily found in supermarkets and markets are Cucurbita moschata, which is a giant pumpkin that tends to be oval and has a taste from fresh to sweet. The characteristics of pumpkin needed in boba products are believed to meet consumer expectations, namely the need to choose a pumpkin that weighs about 2-3 kg or when tapped, the pumpkin is hollow, which means that the pumpkin has a lot of water content in it. Pumpkin has a long shelf life; it can even survive at room temperature for approximately six months but is more easily damaged during distribution because of its large volume. Therefore, it needs to be processed into a more durable product. To be saved. The amount of pumpkin production increased to 523,063 (Santoso, Basito, & Muhammad, 2013).

We chose pumpkin because, in terms of quantity, pumpkin is suitable as a complementary food ingredient (Ariyanti, 2021). Before processing pumpkin into boba topping, it is necessary to prove its suitability and recommendation by food inspection experts scientifically. Creating starch balls from the pumpkin is an effort to create

something innovative, as long as the results are healthy and safe for consumption. This research was conducted to get the best results so that consumers can fully trust the product. The motivation of this research is that we want to prove that the product contains healthy ingredients for consumers of all ages. We investigate whether the panelists prefer the pumpkin-based boba in terms of taste, color, smell, and texture. Thus, we can develop knowledge about the development of boba so that the boba product can be accepted by the consumers. This study also investigates how the color, taste, smell, and texture of boba after being processed and what color, taste, smell, and texture are the most preferred by consumers. We carried out organoleptic tests to ensure the color, taste, smell, and texture through scientific experiments. The organoleptic tests were carried to find out what distinguishes the boba added with pumpkin from the boba in general. Therefore, we conducted a study through the experiment before and after.

LITERATURE REVIEW

As previously explained, boba is one of the most popular toppings. It has become very popular as it can be combined with various drinks, and its sweet taste can increase the body's energy (Yunila, Surhaini, & Suseno, 2021). This implies that the sale of boba drinks is highly profitable due to its popularity among the public, especially young consumers.

Although most consumers are outside big cities, consumers will still come to buy and try boba. It is known that boba or bubble tea drinks have been circulating in the community for a long time. However, boba started to gain popularity in 2018. The trend continued to increase until 2021. Tadesse, Ibrahim, Forsido, & Duguma (2018) said that the total carotenoid content in boba increased due to the content of pumpkin flour. The best sensory attribute of the developed product was around the midpoint of the three ingredients consisting of pumpkin flour, bulla, and spinach sprouts. Competition for outlets that sell boba brown sugar from time to time is increasing due to the innovations they make. Various outlet brands emerges due to high consumer demand.

Nevertheless, there was a significant difference in the composition of the proximate samples. For example, osmotically dried flasks recorded higher mineral content of Ca, Cu, Fe, K, Mg, Mn, and Na. Meanwhile, osmotic pre-dehydration by NaCl significantly affected ascorbic acid. Likewise, the amino acid profile of the oven-dried (unosmo-predried) leaves showed histidine and cysteine, which had high amino acid scores of 120.42% and 135%, respectively. Threonine (43.73%) was the highest essential amino acid (without histidine). The economic evaluation showed that the percentage difference in the cost index of leaves given NaCl 2.08%, sucrose (11.19%), and corn syrup (16.43%) (Ajala, Igidi, Fasuan, & Ominyi, 2020).

From 2011 to 2015, the company with the most significant control in the bubble drink industry was the Chatime brand company. It can maintain consumer desires (Dewi et al., 2015). In Jakarta, boba is such a popular drink that bubble tea or milk tea is not a new thing. This drink has become one of the most popular products since 2018. Consumers can easily find this product. To be able to enjoy it, many are willing to queue for hours in several places. Usually, they are interested in adding toppings to drinks such as boba.

Boba has been on the market for a long time in Indonesia despite its unpopularity. The first companies to produce and sell boba were Quickly and Hop-hop. After that, it began to be popularized again in Taiwan in 2018, along with the emergence of a company,

Tiger Sugar, selling brown sugar boba. The company started to expand its branch to Indonesia. There are several changes in the presentation of bubble tea where, in the past, bubble tea was served only with tea or boiled water with a mixture of various flavors of syrup. However, now bubble tea is made by mixing tea and milk and then adding boba topping.

Boba suitable for bubble tea is that with a chewy texture and not sticky. Now boba has been made into various variations with slightly different flavors. One big company in Jakarta makes a variety of boba called the "Golden bubble." Despite its similar taste, consumers will be interested in trying it because it has a different color from that sold in general. Therefore, researchers want to make something new in the community, namely boba which comes from healthy ingredients (Kamalul Ariffin, Ihsannuddin, & Mohsin, 2021) since the public awareness of illnesses changes their eating habits and demand for healthy food (Chan et al., 2020).

Boba also has several benefits that consumers rarely know. In addition to adding to the sweet taste and enjoyment of the drinks consumed, boba also has good benefits for increasing endurance because it is made from tapioca flour, namely cassava. Boba contains iron, magnesium, manganese, and phosphorus (Kushargina, Yunieswati, & Rizqiya, 2021). Although boba helps boost the immune system, the scientific evidence that the content of boba is healthy for consumption is unavailable. Therefore, we added pumpkin to boba so that it tastes good and is beneficial because it contains protein, carbohydrates, minerals, and vitamins. Boba is also helpful in increasing energy and reducing stress levels in the body since it is made of sugar, lowers cortisol hormone levels, and increases endorphins. Drinking too much bubble drink can increase the risk of various health problems.

There are several types of boba (Chang, Sun, Ohliger, Abuzahriyeh, & Choi, 2020), including mini boba, popping boba, flavored boba, black boba, clear boba (Safitri, Sunarti, Parisudha, & Herliyanti, 2021). We used pumpkin mixture because it is a critical ingredient easily found in food sold in supermarkets and traditional markets. Also, it is rarely processed into unique food products. Pumpkin is used mainly by rural communities to make food served unprocessed with various flavors and colors. Therefore, we developed this pumpkin base material into an essential component for boba. Consumers who consume boba do not need to worry because it contains healthy ingredients. Pumpkin is also suitable as a base material because it has a long shelf life. Pumpkins that are very good to use are bright orange and echoing when tapped, indicating that the pumpkin is hollow but rotten. Choosing a smaller pumpkin is better because it taste sweeter (Kuncoro, 2019).

Several products, such as cookies, chips, compotes, and sweets, are also made from pumpkin. Pumpkin is processed into a puree before being mixed with wheat flour and other ingredients to make cookies (Sudarman, 2018). Saroinsong, Mandey, and Lalujan (2015) noted that mixing glutinous rice flour with mashed yellow pumpkin would become a very delicious porridge. In general, previous studies tend to produce pumpkin-based flour (Budiarti, Wulandari, & Mutmaina, 2020) into cookies and most often processed into chips. Likewise, adding other ingredients to boba mixture affected the organoleptic aspect.

Ambarita (2018) concluded that adding chicken claw powder changes boba texture, color, smell, and taste. In boba with added claw powder, the texture is much softer than

that not mixed with any ingredients. Likewise, boba given another mixture changes color according to the color of the flour mixture. Boba studied in this paper also changes in smell. It still does not turn out to be fishy or bad because of the proper and correct drying process of chicken feet. The processed boba has a savory taste from the fat in processed chicken claw flour (Liu, Cheng, & Wu, 2021).

Therefore, we wanted to create something new, namely, BobaBoba, made from healthy ingredients. In addition to increasing the sweetness and enjoyment of drinks, BobaBoba also has good benefits for boosting the immune system. It is made from tapioca flour, containing iron, magnesium, manganese, and phosphorus (Gorman et al., 2020). TO guarantee its healthiness, we added pumpkin ingredients for its protein, carbohydrates, minerals, and vitamins.

Boba also has good benefits when mixed with green tea-based drinks because they can produce polyphenolic compounds and catechins that help prevent disease (Lei & Lei, 2020).

In previous studies, there has been no research that discusses pumpkin processing as a consumer product in the form of boba. Our organoleptic tests mixed boba with certain ingredients. It showed a significant change in consumer judgment processing (Hansen & Sallis, 2011). Juliana, Kanggeyan, & Sherly, (2020) found that taste, smell, texture, and color of cauliflower croquettes get an excellent rating from the panelists. Based on the hedonic test and hedonic test quality results, the fifth croquette cauliflower with the filling was preferred and given a positive response.

RESEARCH METHOD

This paper was designed with the experimental sensory qualities of Boba developed from Pumpkin. By testing the causal hypothesis, we could find out the possible causes and effects of Pumpkin processed into boba. Based on the previous studies, we obtained additional information to support the primary data collected through experiments with the development of processed boba products. We investigated the color, taste, texture, and smell using pumpkin as the main ingredient. Subsequently, boba was processed by by peeling pumpkin skin and removing the seeds. We boiled and mashed the Pumpkin before mixing it with starch and water. After the boba dough is made, the dough will be divided and formed into circles before boiled with palm sugar water. After that, we compared it with boba on the market. We examined the differences exist between the two organoleptically. After the boba pumpkin is produced, the next step is to test the individual panelists.

This step aims to find out the panelists' opinion and whether the product attracts their attention. The panelist responses were collected from the prepared questionnaire and processed using SPSS. The data obtained and analyzed were used as a benchmark for current organoleptic pumpkin boba enthusiasts. To make the evaluation stage a success, we involved the finalists as a sample who have experience in evaluating food assessment programs. The experienced panelists were those who could describe the differences among the foods they were tasting as appraisers (Kurniawan, 2016). We selected trained panelists based on their work experience in food and beverage.

We conducted two experiments to ensure that the product was good and could be distributed to the panelists. In the first experiment, the product was processed to show

good results, but the texture of the product must be improved because when cooled, the product hardens quickly. We also conducted further research to find ways to eliminate the "unpleasant" smell so that it did not reduce the value when tested. To avoid this, we added vanilla extract to produce a sweet taste and eliminate the "unpleasant" smell. After the second experiment, the product got better results in texture, and the "unpleasant" boba smell was quite reduced (Yuliantoro et al., 2019).

Furthermore, the pumpkin product, questionnaires, and hedonic quality test forms were distributed to 20 trained panelists. The distribution of product results was carried out using a non-probability sampling technique, which does not provide opportunities for every population or existing member (Sugiyono, 2010). The product results and questionnaires were distributed to trained panelists based on predetermined categories.

The panelist age scale was chosen 17-35 because the market for selling boba tea is popular among teenagers and adults, even though boba is mixed with pumpkin additives. The data from trained panelists were collected by quantitative descriptive methods. After sharing product results, we collected data by distributing online forms (questionnaires) and hedonic quality test forms. The figures obtained will be translated descriptively to conclude the research results. In the questionnaire, the panelists were asked to rate how attracted they were to the pumpkin-added boba and rate the color, taste, texture, and smell. The purpose of distributing questionnaires is to determine how interested the panelists are in the new variation of boba (Sue & Ritter, 2012). The reporting of this study was carried out with a quantitative descriptive design, with a Likert scale of 1 (Strongly Agree) to 6 (Strongly Disagree) (Sekaran & Bougie, 2016) to determine the value of individual assessments.

The panelists were trained panelists of 15-25 people, who would be used as a means of differentiation. The tests conducted were only limited to the ability to distinguish (Soekanto & Mamuji, 2007). The trained panelists were kitchen staff at Conrad Bali Hotel and Resort. The 20 selected panelists have experience in the kitchen, pastry, and food and beverage fields obtained from studies conducted during lectures, practical work experience, and working in the culinary industry.

RESULTS

This section describes the results of experimental studies and field data to test the organoleptic, which consists of hedonic quality tests and hedonic tests. In organoleptic testing, the boba's taste, color, smell, and texture were tested by comparing the boba with the added pumpkin base ingredients with the original boba. The boba flavor added to the pumpkin will taste sweeter because of the sweetness of the pumpkin itself. There is also a distinctive taste when consumed, so it is not monotonous.

The boba turned orange, which is very different from the original boba color. The smell of boba was added to the pumpkin when the processing is complete. The bad smell is not very smelly; therefore, it is not too bothersome. The vanilla extract was also added to make the boba aroma sweeter. Moreover, the smell and texture of the boba were chewy and delicious. After the organoleptic test process was carried out, the panelists distributed the boba products. The product is packaged in vacuum packaging and sent to the panelists in the initial stage. It was to identify what needs to be improved and added to make the product better.

After getting opinions from trained panelists, there are six, seven, or nine. In the preference test, the hedonic quality test was used to determine the average of each organoleptic that the researchers tested, namely color, taste, aroma, and texture. The hedonic quality test is made using a measurement scale of 1-6. The results are presented in Table 1.

Table 1. Yellow Pumpkin Boba Hedonic Quality Test Results of Taste

		Frequency	Percentage	Valid Percentage	Cumulative %	Mean	Std. Deviation
Valid	Strongly Disagree	4	20.0	20.0	20.0		
	Disagree	1	5.0	5.0	25.0		
	Agree	3	15.0	15.0	40.0		
	Agreed	9	45.0	45.0	85.0		
	Entirely Agree	3	15.0	15.0	100.0		
	TOTAL	20	100.0	100.0		4.3	1.38

Source: Processed Data Result (2021)

Table 1 shows the frequency of values obtained in terms of the taste of boba pumpkin. Four panelists (20%) strongly disagreed, and one panelist (5%) somewhat disagreed. Three panelists (15%) chose somewhat agree, nine panelists (45%) agreed, and three panelists (15%) strongly agreed. This confirms that the taste gets a value of 4.3, where the panelists entirely agree.

Table 2. Yellow Pumpkin Boba Hedonic Quality Test Results of Color

		Frequency	Percentage	Valid Percentage	Cumulative %	Mean	Std. Deviation
Valid	Totaly Agree	3	15.0	15.0	15.0		
	Agree	4	20.0	20.0	35.0		
	Agreed	6	30.0	30.0	65.0		
	Entirely Agree	7	35.0	35.0	100.0		
	TOTAL	20	100.0	100.0		4.55	1.38

Source: Processed Data Result (2021)

Table 2 shows three panelists (15%) chose to disagree, three panelists (20%) somewhat agree, six panelists (30%) chose to agree, seven panelists (35%) strongly agreed. Table 2 indicates that the average value in terms of color is 4.55, where the panelists agree and are interested in the pumpkin boba.

Table 3. Yellow Pumpkin Boba Hedonic Quality Test Results in Terms of Smell

		Frequency	Percentage	Valid Percentage	Cumulative %	Mean	Std. Deviation
Valid	Entirely Totaly Disagree	2	10.0	10.0	10.0		
	Totally Disagree	1	5.0	5.0	15.0		
	Totally Agree	3	15.0	15.0	30.0		
	Agreed	7	35.0	35.0	65.0		

	Agree	6	30.0	30.0	95.0		
	Entirely Agree	1	5.0	5.0	100.0		
	TOTAL	20	100.0	100.0		3.85	1.34

Source: Processed Data Result (2021)

Table 3 shows two panelists (10%) chose to strongly disagree, one panelist (5%) chose to disagree, three panelists (15%) decided somewhat disagree, 7 panelists (35%) chose somewhat agree, 6 panelists (30%) chose to agree, and one panelist (5%) strongly agreed. This indicates that the average value in terms of aroma is 3.85, where the panelists slightly disagreed with the smell.

Table 4. Yellow Pumpkin Boba Hedonic Quality Test Results in Terms of Texture

		Frequency	Percentage	Valid Percentage	Cumulative %	Mean	Std. Deviation
Valid	Entirelt Disagree	3	15.0	15.0	15.0		
	Totally Agree	6	30.0	30.0	45.0		
	Agree	6	30.0	30.0	75.0		
	Entirely Agree	5	25.0	25.0	100.0		
	TOTAL	20	100.0	100.0		4.65	1.03

Source: Processed Data Results (2021)

Table 4 shows that three panelists (15%) chose to slightly disagree, six panelists (30%) chose somewhat agree, six panelists (30%) agreed, and five panelists (25%) strongly agreed. This illustrates that the average textural score is 4.65, where the panelists quite agree with the pumpkin boba because it has a chewy and soft texture. Furthermore, we conducted a hedonic test to find the average panelist acceptance of each tested organoleptic (see Table 5).

Table 5. Results of the Yellow Pumpkin Boba Hedonic Test

	Taste	Color	Smell	Texture
N	20	20	20	20
Missing	0	0	0	0
Mean	4.3	4.55	4.55	4.55

Source: Processed Data Result (2021)

After conducting a hedonic quality test, the researcher conducted a hedonic test and the mean. We did this to find the average hedonic test using the SPSS analysis model. The average results that the researchers got on the hedonic test on the taste, color, aroma, and texture of the boba fruit. Meanwhile, what was assessed was pumpkin in terms of taste; an average value of 4.3 was obtained, which the panelists liked the taste of boba and did not differ from the taste of boba in general. In terms of color, we got a score of 4.55 from that value; the panelists were interested in the color of the boba after adding pumpkin. The aroma got a score of 4.55, and the panelists agreed with the aroma of boba after being processed. Finally, in terms of texture, it got a score of 4.55, where the

boba texture was favored by the panelists and considered chewy enough to be consumed (see Table 5)

DISCUSSION

Based on the results obtained from data processing, boba without pumpkin, in terms of taste, got an average value of 4.3, whereas the panelists liked the taste of pumpkin boba. In terms of color, the average value is 4.55; in this case, the panelists like the color that occurs after processing. In terms of smell, the average value was 3.85, which means that the panelists did not like the smell produced from processing boba pumpkins. In terms of texture, the average score was 4.65, and the panelists liked the boba texture.

The results of the hedonic questionnaire show that pumpkin is quite attractive to panelists from an organoleptic point of view. In terms of taste, which was examined organoleptically, pumpkin boba obtained an average score of 4.3, which indicated that the panelists agreed and liked the taste.

In terms of color, the pumpkin-based boba got 4.55 points from the panelists. This shows that the panelists like the color of the pumpkin boba, and that color attracts the panelists' attention to consuming it. In terms of aroma, the panelists gave an average value of 4.55, which stated that the panelists agreed and liked the aroma. However, the current results can be explored further, and further experiments are carried out to maximize the processing of the pumpkin so that the unpleasant odor of the pumpkin can be removed so that the smell of the pumpkin does not interfere with its consumption.

In terms of texture, the average score produced is quite good, with 4.55. This value implies that the panelists liked the resulting texture, which is closer to the texture of boba in general but a little chewier due to the presence of starch from pumpkin.

The research results signify that, on average, the panelists like boba products processed from the essential ingredients of pumpkin. The organoleptic test underlined things that must be changed during the processing process. First, in terms of the taste of the pumpkin used, it must be yellowish-orange in color so that the boba has a naturally sweet taste, and the sugar content used must be equal to the amount of pumpkin used. With this, it can be said that the boba does not matter in terms of taste.

In terms of color, the boba added with yellow pumpkin will significantly affect the natural color of the boba because when the pumpkin is added, the boba shows an orange color. As seen in the results section, boba, in terms of color, got the value that the panelists liked, which means there is no problem with the different color from the original boba. In terms of smell, the yellow pumpkin has a distinctive unpleasant smell." We used vanilla extract to eliminate the smell. Finally, in terms of texture, the boba remained chewy, and the panelists like the texture. The amount of starch used must also be appropriate so that the texture does not crumble and remains soft.

CONCLUSION

The results of this study produce very contributive results, and suggestions are expected to help further research. The analysis section is expected to improve the organoleptic aspects of boba. Likewise, the panelists exceptionally well received the color and taste of the pumpkin boba. It is not much different from the boba that panelists have ever or frequently consumed. On the other hand, the aroma and texture of the boba could be improved so that the extraneous smell is removed entirely. In the aroma aspect, the pumpkin can be dried first before being mashed and further processed so that the unpleasant aroma could be minimized. We also added vanilla extract to cover the pumpkin aroma. Texture elasticity becomes better and softer to consume. The elasticity is considered sufficient. However, it can be improved by grinding the boba after boiling it so that the pumpkin pulp particles become acceptable and the texture becomes soft. We suggest conducting further research on the substitute base materials to maximize product yield and final quality. The suggestions we presented will facilitate further research to improve the quality of the aroma and texture.

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