Nutritional content and preference analysis of red dragon fruit spaghetti

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Abstract. Culinology was a mixture between the disciplines of food science and the culinary arts. The development of knowledge, then the culinary field developed by utilizing science that used physics and chemistry. Molecular gastronomy was a field of study that studies chemical and physical reactions as well as the transformations that occur from food during the cooking process and sensory phenomena consumed. One of the applications of molecular gastronomic techniques was the manufacture of fruit spaghetti. Spaghetti is a food that looks like noodles, the ingredients that make spaghetti are wheat flour and eggs. Fruit spaghetti was the spaghetti of fruits, in this case it used red dragon fruit. The purpose of the study to find out: 1) The public interest in dragon fruit spaghetti fruit 2) The content of vitamin C and fiber fruit spaghetti. This type of research is an experiment. The data was analyzed used descriptive of percentages. The results showed: Fondness for fruit spaghetti in aspects of colour, taste, texture and aroma the highest percentage was on the criteria of very like and like in all four sample groups. The more dragon fruit used, the higher the vitamin C and coarse fiber.

1. Introduction
Food technology and science are currently moving dynamically, especially in the culinary field, namely in carrying out food processing techniques to answer the challenges of food security in the future. One technology that is being discussed a lot is molecular gastronomy. Culinology is a blend of the disciplines of food science and the culinary arts. With the development of knowledge, the culinary field also develops the discipline of food science and culinary arts, and utilizes science; the science used in physics and chemistry. Culinary that utilizes the science of physics and chemistry is called molecular gastronomy. According to Youssef [1] molecular gastronomy is a field of study that investigates the chemical and physical reactions and transformations in foodstuffs during the cooking process and sensory phenomena when consumed. Materials used in the molecular gastronomy process, either in chemical reactions or physical reactions that occur in food transformation, are safe for consumption or commonly referred to as food grade or edible.

Molecular gastronomy aims to provide a new experience and sensation when a familiar dish is reconstructed, and it becomes a surprisingly emotional and sensory experience by manipulation of shape. One product that has been reconstructed to become a product manipulated in shape is fruit spaghetti.

Spaghetti is a food that looks like noodles but is thinner with a soft texture, measuring 25-30 cm. The ingredients for making spaghetti are wheat flour and eggs. While fruit spaghetti has a fruity taste and
has a specific viscosity obtained from alginate and jelly, does not contain flour or gluten, and has a noodle-like shape (spaghetti) also can be eaten directly without going through any further processing. The dragon fruit used is red dragon fruit; red dragon fruit contains dietary fibre in pectin, which functions as a gelling agent in fruit spaghetti. Red dragon fruit is rich in betalains [2]. Betacyanin is a type of betalain found in red dragon fruit. Red dragon fruit contains bioactive substances that are beneficial to the body, including antioxidants (ascorbic acid, beta-carotene, and anthocyanins) and contains dietary fibre in the form of pectin [3]. The essential components in the formation of gels are pectin, sugar, and acid.

Knowledge of molecular gastronomy allows chefs to explore the culinary world further scientifically, which can later be applied as the art of molecular cooking. As a result, new technologies or interesting dishes can be created. Meanwhile, consumers are expected to be surprised and satisfied with healthy, delicious, and interesting food.

Molecular gastronomy techniques consist of liquid nitrogen, alginates, vapor, water, vide sauce, slow cooking, powders, other senses, methylcellulose, and transglutaminase [4]. This study using the Alginates technique. Alginate is a thickening agent that can cause a liquid (calcium-based) to become a gel. The alginate used in the manufacture of red dragon fruit spaghetti is sodium alginate with the required gelatinization temperature range of 64.5°C - 70°C [5].

This fruit spaghetti can be made by removing it from a feeding tube. Usually, fruit spaghetti is served cold and used as a dessert [6]. According to Ervina [7], the characteristics of a good fruit spaghetti in molecular gastronomy: 1) can be removed easily from the feeding tube 2) do not break when removed from the feeding tube 3) the texture is not too soft 4) has colour and texture. The fruit flavour used 5) tastes sweet and is usually served cold. Based on the background of the problem, the purpose of this study is to determine: 1) The level of public preference for fruit spaghetti from dragon fruit with molecular gastronomy techniques. 2) The content of vitamin C and fibre from red dragon fruit spaghetti fruit with molecular gastronomy techniques.

2. Method
The type of research used is an experiment with a post-test-only control design. The independent variables in this study were the use of different red dragon fruit and water, namely 250 g: 0 g, 200 g: 50 g, 175 g: 75 g, and 150 g: 100 g, the dependent variable was the level of preference, vitamin C and fibre content. While the control variables are the type of material and the amount of additives used in the manufacturing process with the same treatment on mixing, manufacturing time, temperature, cooling time and packaging. The control variables in this study were conditioned equally in each sample group.

The main ingredients used are red dragon fruit with conditions that are still fresh, intact and ripe and the flesh is not mushy. Other ingredients are white sugar that is clear and does not clot. Another ingredient is alginate; the alginate used is powdered alginate, dry, not agglomerate, and light brown colour. In addition, other ingredients are gelatine; the gelatine used is in powder form, dry and does not clot, and has a white colour. The water used is mineral water which is colourless, tasteless, and odourless.

The tools used include: the food syringe used has a volume of 50 ml, and the feeding tube used has a length of 50 cm with a diameter of 3 mm. The manufacturing process is carried out by mashing dragon fruit, then all ingredients are mixed and cooked until boiling or reaching a temperature of 100°C. The next stage is the suction stage of the fruit spaghetti solution using a food syringe through a feeding tube. It is at this stage that it causes a spaghetti-like shape but has a fruity taste. After that, the cooling process was carried out for 35 minutes in ice water. The following process is removing or pushing this using a feeding tube, and the next step is the packaging process using a standing pouch. Table 1 describes the ingredients used in red dragon fruit spaghetti.
Table 1. Ingredients used in red dragon fruit spaghetti

| No | Name of Ingredients | Experiment Group |
|----|---------------------|-----------------|
|    |                     | Sample A | Sample B | Sample C | Sample D |
| 1  | Red dragon fruit    | 250 g     | 200 g     | 175 g     | 150 g     |
| 2  | Water               | 0 g       | 50 g      | 75 g      | 100 g     |
| 3  | Sugar               | 25 g      | 25 g      | 25 g      | 25 g      |
| 4  | Alginate            | 8 g       | 8 g       | 8 g       | 8 g       |
| 5  | Jelly               | 5 g       | 5 g       | 5 g       | 5 g       |

The implementation stages in the research are: (1) Peel and cut the dragon fruit into smaller pieces. (2) Put the pieces into a blender, then add mineral water and blend until it becomes liquid. (3) Add the dragon fruit liquid into a saucepan, add sugar, alginate powder, agar powder together. Then stir until smooth. (4) Cook on medium heat until the temperature reaches 100°C and stir until the temperature is reached. (5) After the temperature is reached, turn off the stove and let the liquid sit for 2 minutes. (6) Prepare a basin containing water and ice cubes in the form of chunks; this cold water is used to speed up the gelification process. (7) Take the liquid by suction using a food syringe, after that insert it into the feeding tube by pushing the handle of the food syringe until feeding tube full of fruit spaghetti liquid. Do this method repeatedly until the fruit spaghetti liquid runs out, if the fruit spaghetti liquid begins to turn into a gel, then reheat until it turns into a liquid. (8) Place the feeding tube containing the fruit spaghetti liquid into a basin filled with ice water for 7 minutes. (9) After that, remove the fruit spaghetti from the feeding tube by slowly pushing the empty food syringe's handle until all the fruit spaghetti comes out. (10) Put the fruit spaghetti in a plastic packaging or a standing pouch.

The data collection method used in this research is a subjective and objective assessment. Subjective assessment is carried out using a preference test, and objective assessment is carried out in the laboratory. Objective assessment was carried out to determine fibre and vitamin C content in the experimental red dragon fruit spaghetti.

The research instrument is an untrained panellist used to test the hedonic level on a product or to test a person's willingness to use a product. The number of untrained panellists is at least 80 people. Another research instrument is an observation sheet to observe the preference for fruit spaghetti which consists of aspects of colour, taste, texture, and flavour. The scale used on the observation sheet is using a test scale of 1-5. The hedonic scale can be stretched or collapsed according to the desired scale range. Hedonic test can also be converted into a numerical scale with quality numbers according to the level of preference. The test scale used with a value of 1 = dislike, 2 = dislike, 3 = moderate, 4 = like and 5 = very much like. Assessment is done by marking the checklist on the observation sheet.

Data analysis was to determine people's preference for fruit spaghetti with molecular gastronomy techniques using descriptive percentages and to determine the content of vitamin C and crude fibre using laboratory tests. The descriptive percentage is used to describe the preference of the panellists from very to dislike with a score of 5 to a score of 1 with a percent value.

3. Results and Discussion

Fruit spaghetti from this study is red because it comes from red dragon fruit. The next step is to do a preference test. 80 untrained panellists carried out the preference test on red dragon fruit spaghetti products. Each untrained panellist assessed the research samples, namely sample A (250 g dragon fruit: 0 g water), sample B (200 g dragon fruit: 50 g water), sample C (175 g dragon fruit: 75 g water), and sample D (150 g dragon fruit: 100 g water). This preference assessment uses an observation sheet seen from colour, taste, texture, and flavour aspects. Based on preference data based on colour and taste aspects, the results are as in Table 2.
Table 2. Preference Based on Colour and Taste Aspects

| Sample | Colour (%) | Taste (%) |
|--------|------------|-----------|
|        | 5 4 3 2 1 | 5 4 3 2 1 |
| A      | 52.50 33.75 11.25 2.50 0 | 100 41.25 48.75 7.50 2.50 0 | 100 |
| B      | 47.50 35 15 1.25 1.25 | 100 48.75 35.25 13.75 2.50 0 | 100 |
| C      | 37.50 52.50 7.50 2.50 0 | 100 40 43.75 8.75 6.25 1.25 0 | 100 |
| D      | 41.25 41.25 17.5 2.50 0 | 100 35 52.50 11.25 1.25 0 | 100 |

Based on the preference test data based on the texture and flavour aspects, the results are shown in Table 3.

Table 3. Preferences Based on Texture and Flavour Aspects

| Sample | Texture (%) | Flavour (%) |
|--------|-------------|-------------|
|        | 5 4 3 2 1   | 5 4 3 2 1   |
| A      | 46.25 38.75 12.5 2.50 0 | 100 42.5 46.25 10 0 1.25 100 |
| B      | 56.25 30 11.25 2.50 0 | 100 46.25 37.5 10 6.25 0 100 |
| C      | 47.50 40 8.75 2.50 1.25 | 100 41.25 42.5 11.25 5 0 100 |
| D      | 35 46.25 17.5 1.25 0 | 100 31.25 48.75 17.5 2.50 0 100 |

From the data of preference for aspects of colour, taste, texture, and flavour in samples A, B, C, D, the highest percentage varies with a score of 5 or very like and a score of 4 or like, while a score of 3 or quite like, a score of 2 or less like and a score of 1 or dislike the percentage is low. While the levels of vitamin C and fibre contained in red dragon fruit spaghetti fruit from the results of testing in the laboratory can be seen in Table 4.

Table 4. Vitamin C and Fibre Content in Red Dragon Fruit Spaghetti per 100 grams

| No | Sample Code | Vitamin C (ppm) | Rough fibre (%) |
|----|-------------|-----------------|-----------------|
| 1  | A (777) / 112 | 37.777          | 2.2             |
| 2  | B (218) / 242 | 34.585          | 1.6             |
| 3  | C (696) / 677 | 31.079          | 0.9             |
| 4  | D (347) / 741 | 30.079          | 0.7             |

The data shows that Vitamin C and crude fibre data are sorted from the highest to the lowest, namely sample A, sample B, sample C, sample D. The results showed that the preference for aspects of colour, taste, texture, and flavour in samples A, B, C, D, the highest percentage varied with a score of 5 or very like and a score of 4 or like, while a score of 3 or quite like, a score of 2 or less like and a score of 1 or dislike is a low percentage.

The resulting fruit spaghetti is red so the panellists like fruit spaghetti. This is in line with the finding of previous researchers [8,9] that colour is an influential graphic element of packaging because when consumers intend to buy a product, they tend to pay attention to the colour of the packaging first before observing the packaging, other packaging visual elements. Colour selection is very important because it can cause a certain response and attention of consumers. Colour has several functions, namely identity.
function, signal function, psychological function, and natural function. The identity function in marketing food products is very important to show the quality of the food. While the colours in psychology that women generally prefer and in marketing that attract potential buyers are bright colours, such as red, orange, yellow.

The fruit spaghetti that is produced tastes sweet because the ingredients come from dragon fruit and sugar that is preferable to the panelists. In a study conducted on rodents, researchers discovered a hormone. The liver, called FGF21 release this hormone that suppresses the desire to eat sweet food [9]. The resulting fruit spaghetti texture is not too tough and not too soft because the ingredients come from alginate and agar, so the panelists like the fruit spaghetti. If there is a lot of water content, the texture will be softer because more water is bound [10]. The texture and consistency of an ingredient will affect the taste caused by the material. Changes in the texture or viscosity of the material can change the taste and odour that arise because it can affect the speed of stimulation of the olfactory receptor cells and salivary glands. The thicker the material, the less acceptance of the intensity of taste, smell, and taste.

The fruit spaghetti produced has a fruity flavour because the ingredients come from dragon fruit and sugar. According to Thomas [11], humans receive food or food ingredients based on certain characteristics that are described based on the taste, feeling, and perception it produces. The perception in question is a statement that comes from factors of physical appearances, such as colour, size, shape, and physical damage; kinaesthetic factors, such as texture, viscosity, consistency, mouthfeel, and finger feel; flavour factors (enjoyment) or sensation, namely a combination of smell (odour) and taste (taste).

4. Conclusion
Panellists’ preference for fruit spaghetti on the aspects of colour, taste, texture and flavour in samples A, B, C, D, the highest percentage varied with a score of 5 or very like and a score of 4 or like. The higher the dragon fruit used, the higher the content of vitamin C and crude fibre.

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