Organoleptic characteristics of nutmeg tea with variations in the roast time

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Abstract. This study aims to determine the effect of roast time on the organoleptic characteristics of nutmeg tea. The experimental design carried out in this study was a randomized block design (RBD), which is arranged in a factorial consisting of 2 factors with three replications. The factor used was the roast time (S), which consisted of 4 levels, namely S1 (20 minutes), S2 (25 minutes), S3 (30 minutes), S4 (35 minutes), and part of the nutmeg (P) which consisted of 2 levels, namely P1 (fruit skin) and P2 (pulp) to obtain 24 experimental units. The response variables analyzed included organoleptic responses (color, taste, and flavor), both hedonic and hedonic quality. The results showed that the roast time, the nutmeg part, and the interaction between the two affected the color, taste, and flavor of both hedonic and hedonic quality. The nutmeg skin treatment and roasting time were 25 minutes; on average, the panelists responded to 3.96 (very like) color, 3.32 (like) flavor and 2.80 (like) taste hedonic. In hedonic quality, the treatment took 25 minutes, and the skin nutmeg, on average, the panelists responded to 3.35 color (tea-colored), 3.24 flavor (nutmeg flavor) and 2.56 taste (slightly nutmeg taste).

1. Introduction
Tea is one of the favourite drinks and has become a habit of Indonesian society because it has a distinctive taste. Today, the tea consumed has been modified with various ingredients for specific purposes so that the use of herbs and spices has begun to be studied and used. Many spice plants in Maluku have not been fully utilized, one of which is nutmeg.

There are many nutmeg plants (Myristica fragrans Houtt) in the Maluku islands where the potential for a nutmeg commodity in Maluku was 31,624.10 ha, which a smallholder plantation with a total production of 5,512.10 tons/year [1]. The nutmeg plant is known as a spice with economic value and is multipurpose. Apart from functioning as an essential oil-producing plant, nutmeg is also used in the food, beverage, medicine, perfume, and cosmetic industries.

The chemical composition of nutmeg was 1.37% flavonoids, 22.14 mg oxalate, 49.32% saponins, 8.42% alkaloids, and 16.00% phytate [2]. The active ingredients in nutmeg are minerals, Vitamin A, Vitamin B, vitamin C, folic acid, riboflavin, niacin, and many flavonoids. These compounds can interfere with the fungal cell membranes' permeability and change the organic components and nutrient transport, ultimately resulting in a toxic effect on fungi [3].
In making tea, the drying process significantly affects the quality of the tea produced, both chemically, physically, microbiologically, and consumer acceptance. Drying is one of the techniques used to extend storage capacity because it can reduce the water content of food, affecting the appearance, texture, and taste of food [4] and can inhibit the growth of unwanted microbes that can cause damage. Foodstuffs during storage [5][6].

The process of making herbal tea is drying with heat energy. Drying is the process of reducing water from a material using heat energy. [7] added that drying is one way of preservation to reduce water content in the material to inhibit unwanted microbes' growth. Based on previous research conducted by [8], the best temperature and drying time for soursop leaf tea processing is at a temperature of 50˚C with a drying time of 150 minutes. [9] added that medicinal plants' best drying temperatures are 50˚C and 60˚C. Various processes of drying food ingredients have been carried out, one of which is roasting.

The traditional roasting process uses a temperature of 100-200 °C, where heat transfer occurs by conduction. The roasted material is stirred rapidly and continuously so that water vapor is quickly carried out and the heat is uniformly and thoroughly distributed [10][11]. This roasting process is crucial in tea processing, but currently, there is no data on the right roasting time to produce tea according to consumer desires. Nutmeg so that harvesting is usually wasted so that tea was made using the nutmeg's skin and pulp in this study. This study aimed to determine the effect of the part of the fruit used and the roasting time on the organoleptic characteristics of the nutmeg tea.

2. Methods
2.1. Materials
2.2. Material preparation
Material preparation is done by sorting the nutmeg after being harvested. Then wash it with running water to remove dirt and dust that stick. Then peel/peel using a slicer and do the pulp so that the skin and pulp used to have the same thickness. It is weighing the skin and pulp of the fruit before roasting.

2.3. Withering
The nutmeg skin and flesh are roasted, and the roasting time is adjusted according to the treatment used. The factor used is the roasting time (S), which consists of 4 levels, namely S1 (20 minutes), S2 (25 minutes), S3 (30 minutes), S4 (35 minutes), and the part of the nutmeg used (P) which consists of 2 levels, namely P1 (fruit skin) and P2 (pulp). This withering process aims to reduce the moisture content of the nutmeg's skin and pulp before use.

2.4. Reduction in size
The next process is reducing the size of the skin and flesh of the nutmeg using a cruiser. The aim is to facilitate the release of the nutmeg tea components during brewing.

2.5. Packaging
The skin and pulp of the fruit that has been mashed are then weighed at 2 g; 2 g of stevia leaf powder are added and packed using the prepared tea bag.

2.6. Research variable
This study's response variable was the organoleptic analysis carried out on color, taste, and flavour using the hedonic and hedonic-quality test (Table 1).

| Scoring | Hedonic Test | Hedonic Quality Test |
|---------|--------------|---------------------|
|         | Color        | Taste               | Flavor |
| 4       | Very like    | Very like           | Very like |
|         | Color        | tea                 | nutmeg flavor |
| 3       | Like         | Like                | Nutmeg taste |
| 2       | Slightly like| Slightly like       | Nutmeg flavor |
2.7. Statistical analysis
This research was conducted experimentally using a randomized block design arranged in a factorial consisting of two factors and three replications.

3. Results and discussions
Organoleptic testing, including color, taste, and aroma, showed the panellist's response to the resulting nutmeg tea. Color is also crucial in processed and unprocessed food or drinks because color can also provide clues about its chemical changes. Taste is influenced by several factors, namely chemical compounds, temperature, concentration, and interactions with other taste components. Various chemical compounds cause different tastes due to organic compounds found in food ingredients. The effect of temperature can also result in sensitivity to taste, while interactions with other components can affect the taste value. The assessment of smells is influenced by psychological and physiological factors that give rise to different opinions. The flavor of a food or beverage product has a vital role in the assessment and appearance because if it has a distinctive flavor, the product is said to be good. The organoleptic test was carried out using the hedonic test method and the hedonic quality test to determine the level of preference or acceptance of the panelists for nutmeg tea to see whether the product was liked or not.

The results showed that the nutmeg used and the length of roasting time affected the resulting nutmeg tea. The results of further tests showed that the nutmeg parts' treatment and the interaction had a significant effect on the color, taste, and flavor of nutmeg tea, both hedonic and hedonic quality test. The nutmeg rind has the highest panelist acceptance value for the color, taste, and flavor of nutmeg tea both by hedonic test and hedonic quality test. They were compared with the nutmeg pulp (Table 2).

Table 2. The effect of the part of the fruit used on the color, taste, and flavor of nutmeg tea.

| The part of the fruit used | Color (Hedonic test) | Flavor (Hedonic test) | Color (Hedonic quality test) | Flavor (Hedonic quality test) |
|---------------------------|----------------------|-----------------------|-----------------------------|-----------------------------|
| Nutmeg skin               | 3.62 a               | 3.28 a                | 3.32 a                      | 3.32 a                      |
| Nutmeg pulp               | 2.52 b               | 2.54 b                | 2.63 b                      | 2.51 b                      |

Note: Figures followed by different letters show significant differences according to the Tukey test (α = 0.05).

Table 2 shows that the average hedonic assessment of the color, taste, and flavor of high nutmeg rind tea was 3.62 (very like), 2.95 (like), and 3.32 (like) compared to the flesh of the nutmeg 2.52, 2.79, and 2.54, (like). For the hedonic quality test, the average hedonic assessment of the color, taste, and flavor of high nutmeg rind tea was 3.32 (tea color), 2.69 (slightly nutmeg flavor), and 3.32 (nutmeg flavor) compared to 2.63 nutmeg pulp, (slightly tea-colored), 2.07 (slightly nutmeg flavored) and 2.51 (slightly nutmeg flavored). It is suspected that the flavonoid compounds and enzymes found in the nutmeg skin are oxidized by air to produce a specific color, taste, and flavor. Herbal teas rich in phenolic and flavonoid compounds have high antioxidants that can inhibit free radical activity [12].

The results showed that the treatment of roasting time had no significant effect on the color, taste, and flavor of nutmeg tea, both hedonic and hedonic quality (Table 3). Still, the interaction between the treatment of the nutmeg parts and roasting duration had a significant effect.
Table 3. Effect of roasting time on the color, taste, and aroma of nutmeg tea.

| Length of roast time (minutes) | Hedonic test | Hedonic quality test |
|-------------------------------|--------------|----------------------|
|                               | color | taste | flavour | taste | color | flavour |
| 20                            | 3.04 a | 2.96 a | 2.30 a | 2.94 a | 2.52 a | 2.72 a |
| 25                            | 3.22 a | 2.94 a | 2.34 a | 2.92 a | 2.28 a | 2.92 a |
| 30                            | 3.08 a | 2.88 a | 2.40 a | 3.08 a | 2.42 a | 2.94 a |
| 40                            | 2.94 a | 2.86 a | 2.44 a | 2.94 a | 2.30 a | 2.88 a |

Note: Figures followed by different letters show significant differences according to the BNJ test at the 5% level.

Table 3 shows that the interaction of nutmeg skin treatment and roasting time is 25 minutes. The average hedonic assessment of the color, taste, and flavor of high nutmeg tea is 3.96 (really like), 2.80 (like), and 3.32 (like). They compared it to other treatment interactions. For the hedonic quality test, the interaction of nutmeg skin treatment and roasting time was 30 minutes, the average hedonic quality of the assessment of the high nutmeg tea color, taste, and flavor was 3.52 (very tea-colored), 2.72 (slightly nutmeg flavor) and 3.32 (nutmeg flavored) compared to other treatment interactions.

Table 4. Effect of interaction of parts of the nutmeg used and roasting time on the color, taste and aroma of nutmeg tea.

| Response variable | Roast Time (minutes) | 20 | 25 | 30 | 35 |
|-------------------|----------------------|----|----|----|----|
|                   | Hedonic test         |    |    |    |    |
| color             | - Nutmeg skin        | 3.36 bc | 3.96 a | 3.44 ab | 3.32 c |
|                   | - Nutmeg pulp        | 2.72 d  | 2.48 d  | 2.32 d  | 2.56 d |
| taste             | - Nutmeg skin        | 2.80 a  | 2.80 a  | 2.96 a  | 2.74 a |
|                   | - Nutmeg pulp        | 1.80 b  | 1.88 b  | 1.84 b  | 1.64  |
| flavor            | - Nutmeg skin        | 3.32 a  | 3.32 a  | 3.40 a  | 3.08 ab |
|                   | - Nutmeg pulp        | 2.40 b  | 2.56 b  | 1.84 b  | 1.64  |
|                   | Hedonic quality test |    |    |    |    |
| color             | - Nutmeg skin        | 3.24 ab | 3.36 a  | 3.52 a  | 3.16 ab |
|                   | - Nutmeg pulp        | 2.64 c  | 2.48 c  | 2.60 c  | 2.86 bc |
| taste             | - Nutmeg skin        | 2.68 ab | 2.56 ab | 2.72 ab | 2.80 a |
|                   | - Nutmeg pulp        | 2.36 bc | 2.00 cd | 2.12 cd | 1.80 d |
| flavor            | - Nutmeg skin        | 3.24 a  | 3.24 a  | 3.32 a  | 3.08 ab |
|                   | - Nutmeg pulp        | 2.20 c  | 2.60 bc | 2.56 c  | 2.68 bc |

Note: Figures followed by different letters show significant differences according to the BNJ test at the 5% level.

4. Conclusion
The results of the study, it can be concluded that the treatment of nutmeg skin and roasting time of 25 minutes produced tea with organoleptic characteristics including hedonic test, namely 3.96 color (very like), 3.32 flavor (like) and 2.80 taste (like) while hedonic quality test is 3.35 color. (tea color), flavor 3.24 (nutmeg flavor) and 2.56 taste (slightly nutmeg flavor)
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