Characterization of physicochemical properties and sensory profile of red oncom in Dramaga District Bogor Regency

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Abstract
The production methods of red oncom can vary between different producers, leading to differences in sensory characteristics and compounds. This study aimed to characterize the physicochemical and sensory profile of red oncom that are most preferred by consumers. In this study, five samples of red oncom from Dramaga Districts, Bogor Regency, were selected as raw materials for physicochemical and sensory analysis. The proximate content of the five red oncom samples showed high levels of moisture, ash, and fat, but protein content in samples 259, 786, 615, and 478 was low. In contrast, the carbohydrate content in sample 615 was higher than proximate of red oncom by the Ministry of Health Republic Indonesia in 2019. The physical characteristics of color in some samples did not significantly differ in terms of L*, a*, C*, and h* values, although all samples exhibited a significant difference in terms of b* value. The texture characteristics of the five samples showed no significant differences in terms of springiness and cohesiveness, but significant variations were observed in hardness, gumminess, and chewiness. The sensory profiling involved 30 consumer panelists and 18 attributes, with sample 259 emerging as the most preferred among consumers. The analysis of consumption patterns based on five aspects of the food model, considering age and gender categories, revealed significant differences in several aspects, mainly related to food preferences (stir-fried, tutug rice, sauce, and fried oncom), self-conditions (feeling of sadness), and environmental conditions (hot weather). However, a significant difference was observed in the ecological aspect, specifically cold temperatures, when considering the gender category.

1. Introduction
Processing is a way to increase shelf life and improve the sensory characteristics of food products (1), including fermented food products. An example of a product derived from fermentation is an online product. Oncom products are a potential source of nutrition because, during the fermentation process, complex chemicals undergo decomposition into simpler compounds so that they can be easily absorbed by humans. Red oncom is a specialty food originating in West Java. Red oncom is produced with raw materials such as peanut press
cake, solid waste from tapioca production, and residue from soybean curd production fermented with Neurospora sitophila mold to produce red strains (2). Red oncom has nutritional value, when oncom weights 100 g, it has water of 57 g, calories of 187 g, protein of 13 g, fat of 6 g, carbohydrates of 22.6 g, calcium of 96 g, iron of 27 mg, phosphorus of 115 mg and vitamin B of 0.09 mg (3). Red oncom is a food product with a self-life of 1-2 days at room temperature (4).

Red oncoms are generally available and commercially sold as raw materials or as ready-to-consume products. Red oncom is produced by producers using traditional processes. However, market development has led to changes in raw material usage, technology employed during process production, and types of products that consumers will receive. The production of red oncom varies among manufacturers in terms of the production stages and raw materials used, which can affect the physical, chemical, and sensory characteristics of red oncom.

Furthermore, research related to the physical, chemical, and sensory profile of red oncom is minimal, so there is a need to assess this matter. Red oncom, a food product, cannot be consumed directly and must be cooked through roasting. The cooking process forms new compounds via chemical reactions.

Sensory is a test of product quality so that it can be developed regarding its acceptance by consumers (5) using the rate all that apply (RATA) method. According to Ares et al. (6), rate-all-that-apply (RATA) is used to group descriptors that have been determined based on their intensity. This method can identify consumer acceptance levels through sensory testing using attributes such as color, aroma, taste, texture, aftertaste, and overall liking perceived by consumers in red oncom obtained from several stores. This research aims to characterize the physicochemical and sensory profile of red oncom that are most preferred by consumers.

2. Materials and Methods

2.1. Materials and Tools

This study utilized five samples of red oncom obtained from five different stores in the Dramaga District of Bogor Regency. The researcher conducted sample selection in five different places to identify red oncom spread in Dramaga District to achieve the objectives of this research. The five samples of red oncom used in the research were purchased before conducting physical, chemical, and sensory analyses to ensure that the samples were in good condition and had a fermentation period of 48 h suitable for research purposes.

2.2. Sample Preparation

This study used five commercially available samples from five stores. The researchers assigned codes with random numbers, namely, 924, 259, 786, 615, and 478. In this study, a red oncom sample was not used as a control, because the aim was to identify the physical, chemical, and sensory profiles of each sample obtained from different stores. Physicochemical properties were characterized using raw materials from the red oncom samples. Subsequently, sensory profile characterization was conducted on red oncom samples that had been processed by roasting to ensure that no additional seasonings or ingredients were added, which could influence the sensory properties of red oncom.

The red oncom was roasted for 5 min, and all samples were uniformly treated in terms of fire intensity, pan diameter, and heating process across all samples. First, the red oncom
was crushed and washed. Next, the pan was heated for 30 s, followed by roasting the red oncom for 5 min and placing it into small cups, each containing 25 g, for sensory testing.

2.3. Characterization of Physicochemical Properties

2.3.1. Chemical Properties

The chemical properties of the proximate content were analyzed using AOAC (2016). The proximate test on red oncom was used to calculate water content (%) and ash content (%) by the gravimetric method, fat content (%) by the Soxhlet Hydrolysis method, protein content (%) by the Micro Kjeldahl method, and carbohydrates (%) by difference. The carbohydrate content in red oncom was calculated using the total values of reduced protein (%), fat (%), ash (%), and water (%) from the absolute values of the sample (7).

2.3.2. Physical Properties

The physical properties in this study are the texture and color of the red oncom. Texture testing was performed using a probe that was appropriate for the sample type. The test was performed on five red oncom samples, and the average value was recorded. Based on a previous study (8) with cake samples using TA-XT (Stable Microsystems, Ltd., Surrey, U.K). An aluminum cylindrical probe with a diameter of 75 mm is used in double compression “Texture Profile Analysis (TPA)”.

The sample was first cut to a size of 20x20x20 mm as the smallest sample size of the five samples was used in this study. Then, it was compressed from the initial height by 25%, with a pretest speed of 5 mm/s, a test speed of 1 mm/s, and a delay time of 5 s between the first and second compressions. The parameters used to measure the texture of red oncom included hardness, cohesiveness, springiness, gumminess, and chewiness. The hardness was determined to be the maximum value during the first compression. Cohesiveness was calculated based on the area of force with a positive value during the second compression compared with the first compression. Springiness was determined by comparing the length during the second compression with that during the first compression. Gumminess was calculated as the product of hardness and cohesiveness, and chewiness was derived from the multiplication of springiness, cohesiveness, and gumminess.

Color analysis was performed using a Konika Minolta CR-400 chromometer. The DP-400 data processor and CR-400 measurements were turned on to determine the L*, a*, b*, C*, and h* values. The L* (luminance) value indicates the brightness of the color in the product, with a value of 0 (black) to 100 (white). a* indicates the green-red color, where green indicates a negative value and red indicates a positive value. b* indicates a blue-yellow color, where blue indicates a negative value, and yellow indicates a positive value (9).

2.4. Characterization of Sensory Profile

2.4.1. Panelist Screening

This study included 30 consumer panelists. The panelists who were at least 20 years old had consumed red oncom, lived in Dramaga District Bogor Regency, and were disposed to become panelists by following a series of testing activities until completion. These panelists also evaluated the five-aspect food model based on real-life conditions that existed in the lives of consumers when consuming red oncom products. This screening stage involved filling out an online questionnaire with various questions to gather demographic information from
potential panelists. The questionnaire must be filled in, including panelists’ backgrounds, such as name, age, gender, and medical history.

2.4.2. Focus Group Discussion (FGD)

A focus group discussion was conducted with the researcher serving as the panel leader to deliberate on the sensory attributes obtained during the research (10). Consumer panelists who had passed the screening stage then participated in the focus group discussion, which involved smelling and tasting roasted red oncom to discuss the dominant attributes, such as color, aroma, taste, texture, aftertaste, and overall liking. After obtaining the dominant attributes from the focus group discussion, all panelists conducted sensory evaluations using the rate all that apply (RATA) method.

2.4.3. Sensory Profile Test

A sensory profile test was performed using that apply (RATA) method. The roasted red oncom samples were assigned codes and presented randomly to prevent bias and minimize discussion among the panelists (11). The panelists entered their booths, where they were presented with five samples of red oncom and mineral water. Each time the panelist sample changes, it must be neutralized with mineral water. After tasting the sample, the panelists rated it according to the attributes listed in the questionnaire. The scale used was from 1-5, on a scale of 1, indicating that the attribute was perceived as very weak, and a scale of 5, indicating that the attribute was perceived as very strong in the tested sample. If an attribute presented in the sample is not perceived by the panelists, they could leave that attribute blank without providing a rating (11,12).

2.5. Statistical Analysis

Statistical data processing for the characterization of physicochemical properties of red oncom was carried out by Analysis of Variance (ANOVA) test using IBM SPSS Statistics 25 software. For the characteristics of the sensory profile, the data from the apply (RATA) method of roasted red oncom were analyzed using IBM SPSS Statistics 25 and XLSTAT 2020 software. The tools used were Principal Component Analysis (PCA) consisting of a spider web, biplot, and overall liking (13) with Friedman’s test. Friedman’s test was used to identify significant differences in each attribute of the selected sample (14). One-way analysis of variance when the p-value <0.05, the significance is significantly different.

3. Results and Discussion

3.1. Characteristics of Chemical Properties

This research was carried out to characterize the chemical properties of red oncom as raw material proximate contents as can be seen in Table 1. As shown in Table 1, the proximate content of the five red oncom samples showed high levels of moisture, ash, and fat, but the protein content of samples 259, 786, 615, and 478 was low. In contrast, the carbohydrate content of sample 615 was higher than that of red oncom by the Ministry of Health Republic Indonesia in 2019, which consists of water content, 132.56%, ash content, 3.26%, fat content, 13.95%, protein content of 30.23%, and 51.16% carbohydrate content. The production of red oncom generally involves the use of raw materials, such as tofu dregs, peanut press cake, and tapioca production waste, which are fermented using Neurospora sitophila mold. In
particular, red oncom from Bogor Regency was produced using tofu dregs and tapioca production waste as the raw material.

Table 1. Proximate content of red oncom.

<table>
<thead>
<tr>
<th>Samples</th>
<th>Water Content g/100g Material</th>
<th>Ash Content g/100g Material</th>
<th>Fat Content g/100g Material</th>
<th>Protein Content g/100g Material</th>
<th>Carbohydrates g/100g Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>924</td>
<td>289.5±0.57^a</td>
<td>3.56±0.00^d</td>
<td>25.27±0.39^b</td>
<td>32.15±0.39^a</td>
<td>39.02±0.46^e</td>
</tr>
<tr>
<td>259</td>
<td>404.40±1.36^c</td>
<td>3.62±0.02^c</td>
<td>23.96±0.26^c</td>
<td>23.20±0.02^d</td>
<td>49.22±0.25^c</td>
</tr>
<tr>
<td>786</td>
<td>477.75±1.77^a</td>
<td>3.65±0.01^b</td>
<td>26.61±0.18^a</td>
<td>29.12±0.15^b</td>
<td>40.63±0.04^d</td>
</tr>
<tr>
<td>615</td>
<td>393.28±1.77^d</td>
<td>3.53±0.00^e</td>
<td>14.58±0.18^e</td>
<td>21.52±0.41^e</td>
<td>60.37±0.60^a</td>
</tr>
<tr>
<td>478</td>
<td>424.91±1.64^b</td>
<td>3.95±0.00^a</td>
<td>18.20±0.03^d</td>
<td>24.08±0.21^c</td>
<td>53.78±1.18^b</td>
</tr>
</tbody>
</table>

Numbers followed by different letters in the same column indicate that the samples are significantly different at the 5% level by Duncan’s test. The values shown are the mean values of the two repetitions.

Based on the survey findings, samples 259, 786, 615, and 478 utilized tofu dregs and tapioca production waste, whereas sample 924 was made solely from tofu dregs, without tapioca sate and peanut press cake. This variation in the raw materials resulted in different proximate contents among the red oncom samples. The elevated water content in the five red oncom samples was attributed to prolonged fermentation, choice of starter, and percentage of raw materials utilized. The water content increased due to the use of Neurospora sitophila mold and tofu dregs as substrates, resulting in a red oncom with a wet and watery consistency (15).

The ash content of red oncom is influenced by the type of substrate and mold used, causing the transformation of organic material into inorganic components during fermentation (15,16). The duration of fermentation increased the activity of enzymes, including proteases, which affected the protein content of the red oncom. Protease enzyme levels increase when the mold is in the exponential phase. During this phase, the mold utilizes the nutrient content of substrates for growth and development, ultimately leading to the optimal conditions for producing protease enzymes, resulting in increased protein content (17). Furthermore, the protein content increases through mold growth because it produces mycelia (17). The fat content in red oncom decreased during fermentation because the mold utilized fat as an energy source for its growth. Carbohydrates in red oncoms are influenced by the percentage of water, ash, protein, and fat content.

3.2. Characteristics of Physical Properties

This study was conducted to characterize the physical properties of red oncom in terms of its color and texture. Color is one of the parameters used by consumers to determine the quality of food products. Color can be analyzed by determining the values of L*, a*, b*, C*, and h*, which can be obtained from a tool chromameter as follows:

Table 2. Color of red oncom.

<table>
<thead>
<tr>
<th>Samples</th>
<th>L*</th>
<th>a*</th>
<th>b*</th>
<th>C*</th>
<th>h</th>
</tr>
</thead>
<tbody>
<tr>
<td>924</td>
<td>74.76±2.68^a</td>
<td>11.30±1.13^b</td>
<td>44.92±3.40^c</td>
<td>46.36±3.22^b</td>
<td>75.82±1.96^a</td>
</tr>
<tr>
<td>259</td>
<td>77.61±1.32^a</td>
<td>12.48±2.22^b</td>
<td>47.00±3.10^bc</td>
<td>48.65±3.40^b</td>
<td>75.18±2.03^a</td>
</tr>
<tr>
<td>786</td>
<td>75.19±1.37^ab</td>
<td>22.86±5.90^a</td>
<td>50.27±5.47^abc</td>
<td>55.30±7.40^a</td>
<td>65.87±3.30^ab</td>
</tr>
<tr>
<td>615</td>
<td>73.11±0.78^b</td>
<td>23.14±1.75^a</td>
<td>52.00±1.89^ab</td>
<td>59.93±2.26^a</td>
<td>66.03±1.28^b</td>
</tr>
<tr>
<td>478</td>
<td>72.63±1.37^b</td>
<td>22.65±1.93^a</td>
<td>54.72±4.70^a</td>
<td>59.23±2.42^a</td>
<td>67.53±1.37^b</td>
</tr>
</tbody>
</table>

Numbers followed by different letters in the same column indicate that the samples are significantly different at the 5% level by Duncan’s test. The values shown are the mean values of four repetitions.
Based on Table 2, represents the results obtained from the color analysis using the Konica Minolta CR-400 chromameter. The L* values obtained ranged from 72.63 to 77.61, indicating that all samples had bright colors. When the L* value is below 50, it indicates a dark color; when it is above 50, it indicates a bright color (18). The a* values indicate the green-red color in the samples, ranging from -80 to +100.

The results in this study show a* values ranging from 11.30 to 23.14, indicating that all samples have a red color. b* values indicate a blue-yellow color, ranging from -70 to +70. A positive b* value implies a yellow color, whereas a negative b* value implies a blue color (19). The range b* from samples red oncom 44.92-54.72, which indicates that the color of the samples is yellow. The C* value for all samples red oncom is positive, which indicates a bright color, while h* values represent the color in a range of 0° until 360° consisting of red, yellow, green, cyan, blue, and magenta. The h* values for all red oncom samples ranged from 67 to 75, which indicates a yellow color consistent with the b* values.

The differences in L*, a*, b*, C*, and h* values of the red oncom color were influenced by the duration of fermentation and the distribution of spores produced by the Neurospora sitophila mold. Food products fermented using Neurospora sitophila mold typically exhibit cream, orange, and brown colors (15). Alterations in the physical properties and chemical composition can also affect the color of food products (20). The color of red oncom was further affected by β-carotene as a pigment responsible for the reddish-yellow color, which exhibited a positive correlation with the concentration of Neurospora sitophila mold during the fermentation process (21).

### Table 3. Texture of red oncom.

<table>
<thead>
<tr>
<th>Samples</th>
<th>Hardness</th>
<th>Springiness</th>
<th>Cohesiveness</th>
<th>Gumminess</th>
<th>Chewiness</th>
</tr>
</thead>
<tbody>
<tr>
<td>924</td>
<td>424.90±11.17&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.83±0.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.58±0.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>245.11±6.19&lt;sup&gt;c&lt;/sup&gt;</td>
<td>203.83±9.48&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>259</td>
<td>336.85±22.13&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.89±0.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.58±0.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>195.22±11.67&lt;sup&gt;d&lt;/sup&gt;</td>
<td>173.16±9.21&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>786</td>
<td>544.00±21.92&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.85±0.05&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.59±0.02&lt;sup&gt;a&lt;/sup&gt;</td>
<td>319.30±0.76&lt;sup&gt;a&lt;/sup&gt;</td>
<td>269.83±15.33&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>615</td>
<td>465.80±17.96&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.86±0.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.59±0.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>273.13±9.67&lt;sup&gt;b&lt;/sup&gt;</td>
<td>235.39±5.10&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>478</td>
<td>152.00±29.98&lt;sup&gt;d&lt;/sup&gt;</td>
<td>0.84±0.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.61±0.02&lt;sup&gt;a&lt;/sup&gt;</td>
<td>91.20±14.86&lt;sup&gt;e&lt;/sup&gt;</td>
<td>76.75±14.20&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Numbers followed by different letters in the same column indicate that the samples are significantly different at the 5% level by Duncan's test. The values shown are the mean values of four repetitions.

Based on Table 3, the texture of red oncom as a raw material was analyzed using a Texture Analyzer-XT instrument. The first parameter is hardness, which represents the ability of the product to change its shape and is obtained from the maximum value of the first compression. Springiness occurs when the product returns to its original shape after the first and second compressions (22). Based on Table 3, springiness was not significantly different among the five samples.

Cohesiveness refers to the area under the curve from the second to the first compression (23). Based on Table 3, cohesiveness values did not differ significantly among the five samples. Gumminess is a characterizes a semi-solid food substance with low hardness and high cohesiveness, resulting in lower gumminess values (22). The gumminess value refers to the energy required to chew the red oncom until it can be swallowed. Based on Table 3, all red oncom samples displayed significant differences. The last category of texture is chewiness, which represents the effort required to chew semi-solid food. Based on Table 3, the chewiness values varied significantly among all samples.
Texture is one of the attributes used to assess food product quality, taste, nutrition, and appearance (21). The texture of red oncom is influenced by fermentation time and raw materials, including solid waste from tapioca production. Solid waste from tapioca production can improve the texture of red oncom produced during fermentation. Based on a survey of the producer, the red oncom used in this research was fermented for 48 h at room temperature using the back-slopping method as a starter, which significantly affected the texture of red oncom (24). The texture increased and became more compact, tender, mold, pH, and reducing sugar. The duration of fermentation of red oncom is also suspected to be positively correlated with increased hardness, springiness, and chewiness, possibly due to the influence of filamentous fungus content and degradation in supporting structures such as fibers (21).

3.3. Characteristics of Sensory Profile Red Oncom

Sensory profile testing was conducted to determine the preferred attributes and samples of the red oncom. The research commenced with screening panelists who filled out a questionnaire that had been validated and tested for reliability using Google forms. A total of 37 respondents participated in the questionnaire; 30 respondents completed it online, and seven respondents completed it offline. Five respondents did not pass the screening phase to fail to meet the researcher’s criteria, and two qualified respondents passed but did not participate in the subsequent rate of testing.

The data consisted of 30 panelists, comprising 8 males and 22 females. The eligible panelists participating in the testing were aged between 20-25 totaling 24 panelists, whereas six panelists were age range–26-30. After gathering the 30 panelists, a focus group discussion was initially held, attended by 10 representatives with 18 attributes.

The sensory attributes to be evaluated in the sensory test, based on the outcomes of the focus group discussion (FGD), encompass attributes generated by the roasted red oncom. These attributes include aroma (beany, musty, fermented, and sourness), color (golden yellow, brownish yellow, and blackish brown), and texture (juicy, chewiness, soft, and fibrous). The attributes taste, namely savory/umami, bland, bitter, and sourness, and aftertaste, namely bitterness, sourness, and tartness. The subsequent step involved the sensory profiling of red oncom using the rate all that apply (RATA) method, utilizing the principal component analysis (PCA) tool as can be seen in Figure 1.

Based on Figure 1, the relationship between samples, where the proximity of samples suggests similar or almost identical attributes, whereas samples located in opposite quadrants imply differences in attributes (10). The F1 and F2 values accounted for 78.67% of the variability in the data, signifying that F1 and F2 adequately explained the attributes. The percentages of F1 and F2 were influenced by the positioning of the red lines and the points associated with each attribute. The greater distance between the red and central points indicated improved explanatory power of F1 and F2. When the lines with red points were situated close to the central point, it suggested that panelists perceived the attribute as similar across all samples.
In Figure 1, it is evident that the roasted red oncom with sample code 786 (quadrant I) displayed dominant attributes, including sourness and bitterness in taste, tartness aftertaste, fermentation, musty, sour aroma, and golden yellow color. On the other hand, samples with codes 615 and 924 (quadrant II) exhibited similar sensory attributes at both occupied quadrants, featuring dominant characteristics such as fibrous and juicy texture, yellow-brown and dark-brown color, bitter aftertaste, beany aroma, and savory/umami taste. Sample 259 (quadrant III) was characterized by sensory attributes such as chewiness, texture, and bland taste, yet it stood out as the most preferred sample overall. Meanwhile, sample 478 (quadrant IV) displayed dominant sensory attributes, such as a sour aftertaste and soft texture. The characteristics of the sensory profile of roasted red oncom also resulted in overall liking or consumer preference for all samples, as shown in Figure 2.

Based on Figure 2, the intensity of the sensory attributes for each sample is detailed. The evaluation used a 1-5 intensity scale, where higher scores (5) indicate a stronger perception of the attribute. The results showed that the intensity of the sensory attributes perceived by panelists varied among the roasted red oncom samples (Figure 2). This variation is affected by factors such as microorganisms, substrate, pH (acidity), temperature, oxygen, and water activity (aw) (25). As a result, a food product’s chemical composition can differ, and often fermentation products are not stable and vary from one another (26).

Based on Figure 2, it was evident that sample 259 emerged as the preferred choice among all panelists. Sample 259 boasted the dominant attributes with the highest intensity ratings, particularly in terms of chewiness in texture, bland taste, and beany aroma. Furthermore, sample 259 exhibited the lowest intensity ratings for sensory attributes such as bitter taste and aftertaste, sour taste and aftertaste, musty and fermented aroma, and sourness compared to the other samples.
These attributes are believed to be less preferred by panelists if they are excessively pronounced in roasted red oncom, which is why panelists rated sample 259 as the most preferred. The sensory attributes observed in all red oncom samples in this study were suspected to be affected by the fermentation time and the choice of raw materials used. The duration of fermentation of food products can influence taste development (27). Fermentation can result in increased acidity; therefore, an extended fermentation period may result in a stronger sour taste due to elevated levels of alcohol and total acid. When total acidity rises, the resulting red oncom will likely have a sour taste and aftertaste, which panelists may favor less. Therefore, we focus on the fermentation duration and choice of raw materials in red oncom production that aligns with consumer preferences.

Sensory profiling was also conducted using a five-aspect food model for roasted red oncom under real conditions. At this time, in conducting sensory evaluation, it is not enough just to perceive it, but there is a need for evaluation in real conditions (28). This study was conducted by distributing a questionnaire that contained questions related to the consumption patterns of red oncom. The respondents to this survey were panelists who had been selected during the sensory evaluation. The questionnaire included several question categories grouped into five main aspects as can be seen in Table 4.

**Table 4. Five aspects food model of red oncom in real condition.**

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Age</th>
<th>p-value</th>
<th>Gender</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20-25</td>
<td></td>
<td>Male</td>
<td></td>
</tr>
<tr>
<td></td>
<td>26-30</td>
<td></td>
<td>Female</td>
<td></td>
</tr>
<tr>
<td>Food</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stir-Fried</td>
<td>3.52±1.02</td>
<td>0.076</td>
<td>3.63±1.19</td>
<td>0.922</td>
</tr>
<tr>
<td>Tutug Rice</td>
<td>3.00±1.13</td>
<td>0.026</td>
<td>3.13±0.99</td>
<td>0.842</td>
</tr>
<tr>
<td>Sauce Oncom</td>
<td>3.23±0.90</td>
<td>0.003</td>
<td>3.50±0.76</td>
<td>0.823</td>
</tr>
<tr>
<td>Fried Oncom</td>
<td>3.04±1.05</td>
<td>0.021</td>
<td>3.38±1.06</td>
<td>0.678</td>
</tr>
<tr>
<td>Combro</td>
<td>3.45±1.27</td>
<td>0.340</td>
<td>3.63±0.92</td>
<td>0.838</td>
</tr>
<tr>
<td>Lontong</td>
<td>3.38±1.18</td>
<td>0.931</td>
<td>3.75±1.16</td>
<td>0.302</td>
</tr>
<tr>
<td>Hot Weather</td>
<td>2.48±0.83</td>
<td>0.004</td>
<td>2.25±0.46</td>
<td>0.178</td>
</tr>
<tr>
<td>Environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rainy Weather</td>
<td>3.52±1.02</td>
<td>0.780</td>
<td>3.75±0.71</td>
<td>0.312</td>
</tr>
<tr>
<td>Hot (°C)</td>
<td>3.86±1.06</td>
<td>0.780</td>
<td>3.63±1.06</td>
<td>0.444</td>
</tr>
</tbody>
</table>
the proximate content specified by the Indonesian Ministry of Health (2019). The physical characteristics of color in some samples exhibited a lower carbohydrate content, while the remaining samples had a lower carbohydrate content than the proximate content specified by the Indonesian Ministry of Health (2019). The physical characteristics of color in some samples did not differ significantly in terms of L*, a*, C*, and h* values, although all samples exhibited a significant difference in terms of the b* value. No significant differences were observed in springiness and cohesiveness among the samples; however, they were significantly different for all texture categories.

Sensory profiling of red oncom was conducted using 30 consumer panelists, identifying 18 sensory attributes and overall liking. Sample 259 was the most preferred among the samples, as it exhibited the lowest sensory attributes for bitter and sour tastes, bitter and sour aftertastes, and sour aroma. Furthermore, the analysis of consumer consumption patterns for red oncom in real-life conditions was conducted using the five aspects of the food model, which included categories such as food, environment, with whom, self-condition,
time, and place, categorized by age and gender. The results revealed significant differences in several aspects, including categories such as food (stir-fried, tutug rice, sauce, and fried oncom), self-condition (sadness), and environment (hot weather). However, in the gender category, a significant difference was observed in the aspect of environment (cold temperatures).

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**Author Contributions**

D.H. and N.D.Y designed and performed the experiments; F.L.K., D.H., N.D.Y., P.H, I.S., and S.Y. analyzed the data and wrote the paper; D.H and N.D.Y are the supervising lecturers.

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**Institutional Review Board Statement**

The human research protocol was approved by the IPB University’s Commission on Research Ethics Involving Human Subjects (number 860/IT.3). KEPMSETIPB/SK/2023.

**Data Availability Statement**

Available data was presented in the manuscript.

**Conflicts of Interest**

Authors may declare no conflict of interest.

**References**


