Abstract

Purpose; To prepare gluten free noodles, tapioca starch added to dry rice flour to prepare noodles, and color, texture and sensory evaluation were performed to determine the optimum amount of starch added. As a result of measuring the color value of rice noodle, TS10(10% of tapioca starch, 90% of dry rice flour) was the most similar in lightness. As a result of texture measurement of rice noodles, the hardness of rice noodle added with tapioca starch increased with the addition of starch, and the chewiness and cohesiveness were significantly higher than that of rice noodles. The addition of 5% and 10% of tapioca starch added to dry rice flour showed similar results to that of commercially available rice flour noodles. Therefore, the amount of starch added to dry rice flour is thought to be 5% and 10% of tapioca starch.

[Keywords] Investigation, Gluten Free Noodles, Dry Rice Flour, Texture, Sensory Evaluation

1. Introduction

Noodles make dough by putting water into grain flour. And it is a food made by pulling out slender long. It is a processed food made from a typical wheat flour, which is made by mixing salt and water in flour, mixing water and putting it into the unique properties of wheat gluten[1]. Rice noodle made from rice has low sodium content, rich in fiber, easy to digest carbohydrate[2], However, it is less volume and less elastic than wheat flour noodles. Therefore, rice flour added with gluten in rice flour noodles is being studied[3][4][5]. But gluten causes Celiac Disease[6]. Therefore, for the health of consumers, it is urgent to develop rice noodles without added gluten. At present, rice consumption is significantly decreasing[3]. In order to increase the consumption of rice, it is urgent to develop various processed foods using rice[7][8]. To improve the cooking aptitude of rice noodles, physical properties need to be improved. Research has been reported on the use of starch obtained by a chemical modification process as a method for improving such physical properties[3][9]. However, there is an urgent need to study how to solve this problem. Tapioca starch made from cassava roots is high in digestion and absorption. When added, it increases the texture and moisture content. So it is mainly used when processing gluten free food.

In this study, we aimed to promote the consumption of rice and to make rice noodles safe from gluten. We prepared noodle rice without gluten by adding natural tapioca starch to dry rice flour which can be easily obtained, and we tried to determine the optimum amount of tapioca starch by measuring texture, color and sensory evaluation.

2. Experimental Methods

2.1. Color value measurements

The color value was measured using color meter(Color meter, JC-801, Color Techno Co, LTD, Japan); the rice noodles was put into cylindrical
container(35×10 mm); each sample was measured five times and its average was used.

2.2. Texture measurements

After sugaring of the rice noodles, its Hardness, Springiness and Chewiness were measured using Texture analyzer (TA-XT Express, Stable Micro Systems, UK) with 70 mm cylinder probe (Pre-test speed: 1.0 mm/s, Test speed: 0.5 mm/s, Post-test speed: 0.5 mm/s, Distance: 2.0 mm, Time: 5.0 sec, Trigger Force: 5.0 g).

2.3. Sensory evaluation

The sensory evaluation items were measured transparency, glossiness, savory flavor of rice, savory taste of rice, smoothness in mouth, hardness and chewiness, after taste, and the preference items were the appearance, flavor, taste, texture, overall acceptability, 1 point is very bad (very weak), and 7 points is very good (very strong).

2.4. Statistical methods

The results of rice noodles Texture, color value and sensory evaluation were analyzed using ANOVA, and the significance test was done through Duncan’s multiple test at p<0.05. The analysis used SPSS WIN program 20.0.

3. Results and Discussion

3.1. Color value of rice noodles

<Table 1> shows the results of measuring the color of rice noodles prepared with rice noodles by adding tapioca starch. The lightness (L value) of the control of Vietnamese rice noodle was 66.38, and the lightness of the rice noodle TS made only with dry rice flour was 63.29. Rice flour added with tapioca starch was 62.82-68.85, which showed significant difference between the samples. As the amount of tapioca starch added increased, the lightness of rice flour increased.

The yellowness value (b value) was -0.64 for the control and -6.18 for the TS. The yellowness of rice noodle added with tapioca starch was 1.83 - 0.26, which was significantly higher than that of rice noodle added with tapioca starch. Kim (2011) also showed that the b value increased with increasing amount of semolina [10].

As a result, noodles were prepared by adding tapioca starch to dry rice flour and TS10(10% of tapioca starch, 90% of dry rice flour) was found to be the most similar to the commercially available rice noodles.

Table 1. Color values of rice noodles made with dry rice powder and tapioca starch.

<table>
<thead>
<tr>
<th></th>
<th>L value</th>
<th>b value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>66.38±0.00</td>
<td>-0.64±0.01</td>
</tr>
<tr>
<td>TS</td>
<td>63.29±0.42</td>
<td>-6.18±0.20</td>
</tr>
<tr>
<td>TS5</td>
<td>62.82±0.02</td>
<td>-1.83±0.03</td>
</tr>
<tr>
<td>TS10</td>
<td>67.67±0.01</td>
<td>-1.31±0.01</td>
</tr>
<tr>
<td>TS15</td>
<td>68.68±0.01</td>
<td>0.01±0.02</td>
</tr>
<tr>
<td>TS20</td>
<td>68.85±0.02</td>
<td>0.26±0.012</td>
</tr>
<tr>
<td>F-Value</td>
<td>692.85***</td>
<td>81.94***</td>
</tr>
</tbody>
</table>

Note: *Control: Finished product rice noodles of Vietnam. 
**Fixed rice powder: tapioca starch ; 95:5, 90:10, 85:15, 80:20
***Mean±SD. **p<0.001.
****Means in a row by different superscripts are significantly different at the p<0.05 by Duncan’s multiple range test.

3.2. Texture of rice noodles

<Table 2> shows the results of measuring the texture of rice noodles by adding tapioca starch to rice flour.

Hardness was measured as 841.20 g/cm² for the control and 360.00 g/cm² for the TS. TS5 was 364.23 g/cm², TS10 was 408.86 g/cm², TS15 hardness was 433.20 g/cm², and TS20 was 550.83 g/cm². The hardness of rice noodles increased significantly with the addition of tapioca starch compared to rice noodles prepared only with 100% dry rice flour. In Yun (2011) study on the addition of tapioca starch, the hardness of rice bread decreased as the amount of tapioca starch added increased [11].

The results of springiness are as follows. The elasticity of rice noodles decreased with the addition of tapioca starch compared to rice noodles prepared only with 100% dry rice flour. The elasticity of rice, noodles, and rice were lower than those of control 0.72, TS 0.92, TS5 0.86, TS10, TS15 and TS20 were 0.83.

The chewiness of rice noodles was the highest at 558.1 in the control, and the chewiness of rice noodle TS prepared with 100% dry rice flour was 279.11. The chewiness of rice noodle added with...
Tapioca starch was 279.84 - 390.63. It is thought that, as in the hardness measurement results, when noodles are prepared by adding tapioca starch to rice flour, the small particles of starch and the large particles of rice are well mixed with each other, and the texture becomes tight and the noodles become hard.

Dry rice flour was prepared by adding tapioca starch to make rice noodle and texture. The result showed that hardness, chewiness were lower than that of control rice noodle, which is a commercial rice noodle. It is considered that the content of amylose and amylopectin in rice is different, and the addition of starch to rice noodles makes it harder and harder than that of noodles made with 100% rice. As the amount of starch added increases, hardness, chewiness.

**Table 2. Texture of rice noodles made with dry rice powder and tapioca starch.**

<table>
<thead>
<tr>
<th></th>
<th>Hardness</th>
<th>Springiness</th>
<th>Chewiness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control¹</td>
<td>3841.20</td>
<td>±28.53</td>
<td>558.18</td>
</tr>
<tr>
<td></td>
<td>±28.53</td>
<td>±0.64</td>
<td>±35.37</td>
</tr>
<tr>
<td>TS</td>
<td>360.00</td>
<td>±25.06</td>
<td>279.11</td>
</tr>
<tr>
<td></td>
<td>±25.06</td>
<td>±0.02</td>
<td>±10.75</td>
</tr>
<tr>
<td>TSS</td>
<td>364.23</td>
<td>±27.10</td>
<td>279.84</td>
</tr>
<tr>
<td></td>
<td>±27.10</td>
<td>±0.01</td>
<td>±17.40</td>
</tr>
<tr>
<td>TS10</td>
<td>408.86</td>
<td>±8.52</td>
<td>289.12</td>
</tr>
<tr>
<td></td>
<td>±8.52</td>
<td>±0.05</td>
<td>±12.10</td>
</tr>
<tr>
<td>TS15</td>
<td>433.20</td>
<td>±17.31</td>
<td>324.14</td>
</tr>
<tr>
<td></td>
<td>±17.31</td>
<td>±0.02</td>
<td>±13.90</td>
</tr>
<tr>
<td>TS20</td>
<td>550.83</td>
<td>±4.30</td>
<td>390.63</td>
</tr>
<tr>
<td></td>
<td>±4.30</td>
<td>±0.02</td>
<td>±9.98</td>
</tr>
<tr>
<td>F - Value</td>
<td>377.697</td>
<td><strong>4.090</strong></td>
<td>66.892</td>
</tr>
</tbody>
</table>

Note: ¹Control: Finished product rice noodles of Vietnam
      ²TS: Rice noodles made of dry rice powder 100%
      ³TS5, TS10, TS15, TS20 (Dry rice powder : Tapioca starch; 95.5, 90.10: 85.15, 80:20)
      ⁴Mean±S.D. **p<0.01**, *p<0.05
      ⁵Means in a row by different superscripts are significantly different at the p<0.05 by Duncan’s multiple range test.

3.3. Sensory evaluation of rice noodles

Dried rice flour was prepared by adding tapioca starch to rice flour and subjected to sensory evaluation. Transparency of rice noodles was the most transparent in TS20, and there was a significant difference between the samples. The glossiness TS20 was the highest among the samples. The savory flavor and taste of rice were lowest in the control group, and TS had the strongest savory taste of rice. The smoothness in mouth was not significantly different. Hardness and chewiness were significantly higher in TS20 than in other samples, TS was lowest, and noodles were harder as tapioca starch was added. Smoothness in mouth was not significantly different, and hardness and chewiness were significantly higher in TS20 than in other samples. The after taste of rice noodles was significantly stronger at TS.

As a result of the preference test, TS20 showed the most favorable appearance, and appearance was preferred with increasing amount of tapioca starch. The flavor of TS was the most favored compared to other samples, and taste of Control and TS were significantly similar and TS5 and TS10 were significantly similar. The control group showed a higher preference for texture than the other samples, and the overall acceptability was favored by the TS5 and TS10 were significantly higher.

Therefore, addition of tapioca starch, rice noodles, and taste test were evaluated. The addition of 5% and 10% of rice noodle added tapioca starch was also evaluated. The amount of starch added to dry rice flour is thought to be 5% and 10% of tapioca starch.

**Figure 1.** Quantitative descriptive analysis results of noodles made with dry rice powder and tapioca starch.

**Figure 2.** Quantitative descriptive analysis results of noodles made with dry rice powder and tapioca starch.
4. Summary and Conclusion

To prepare noodles without added gluten, tapioca starch was added to dry rice flour to prepare noodles, and color, texture and sensory evaluation were performed to determine the optimal amount of tapioca starch and to easily make 100% rice noodle at home.

(1) The color of rice noodle with tapioca starch added to dry rice flour was significantly similar to that of commercially available rice noodle with TS10 similar in lightness.

(2) The hardness of rice noodle added with tapioca starch increased with the addition of starch, and the chewiness, and cohesiveness were significantly increased.

(3) The rice noodle added with tapioca starch showed no significant difference from the control group in transparency, gloss, fragrance and taste of rice, hardness, chewiness, and aesthetics. It was found that 5% and 10% of tapioca starch was evaluated well there was.

Therefore, the addition of proper tapioca starch added to dry rice flour is considered to be 5% and 10%, and it is possible to manufacture rice noodle added with tapioca starch.

5. References

5.1. Journal articles


5.2. Thesis degree


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