Abstract

People living this modern world where not only changes in the food culture but also many other factors that have harmful effects on their health find the means to prevent the various habit diseases and adult diseases from the food products they encounter all the time. The junkwa traditional food in Korea, and how it is difficult to manufacture. So very high calorie.

In this study, using the rice cooker is to simplify the method of junkwa made with fresh ginseng. The following is the summary of the study.

This study examined low calorie sweeteners (xylitol, oligosaccharide, stevioside, erythritol) instead of sugar for fresh ginseng junkwa to satisfy customers' health needs. After adding sugar, xylitol, oligosaccharide, stevioside and erythritol to fresh ginseng junkwa. The fresh ginseng(Gangwha, 4 yrd old) chosen to make junkwa adding xylitol, oligosaccharide, stevioside, erythritol were 2cm in width and 15 cm in length that were fairly straight in shape. Fresh ginseng was cut into pieces of 7 mm thickness and 500 g of the cut ginseng were parboiled in 1L of boiling water in a pot(stainless, diameter : 20 cm, height : 15 cm). The fresh ginseng was then drained off of water on a mesh strainer and the 500 g of water that was boiled with fresh ginseng and 500 g of sugar were put together in an electronic rice cooker and were stirred to melt the sugar. When the sugar was totally dissolved into water, the 500 g of previously boiled fresh ginseng pieces were put into boiled liquid and was boiled down together for 205 minutes, and then was drained off the liquid on the mesh strainer and was examined for the experiment. Fresh ginseng junkwa added with xylitol, oligosaccharide, stevioside, erythritol were also produced through the same procedure. The fresh junkwa produced were put into experimentation under the room temperature of 24℃ for 12 days.

The moisture level of junkwa made with fresh ginseng at different sweeteners were the lowest in the added with oligosaccharide. The chewiness and L-values were same to the lowest in the added with oligosaccharide. The difference in sweet taste showed that the fresh ginseng junkwa with oligosaccharide met the requirement of all storage periods.

Therefore, oligosaccharide was a good ingredient for fresh ginseng junkwa.

[Keywords] Junkwa, Sweetener, Fresh Ginseng, Moisture Level, Sugar Level

1. Introduction

Health supplementary food products and health purpose food products refer to the easily encountered foods that are taken for the purpose of preventing various habitual diseases and adult diseases, and interests in the consuming of not only the staplefoods but side foods, snacks, and drinks of such products are increasing.

Along with newly standing out food ingredients, modern day people are considering traditional medication ingredients as health
supplementary food and health purpose food, and amongst the most consumed and also produced as processed food products is the Korean fresh ginseng[1].

So far the researches on the use of fresh ginseng or ginseng were with traditional folk wine[2], yogurt[3], cookies[4] but there barely has been a research on Korea’s traditional junkwa which is capable of mass production.

Korean traditional snack junkwa has a sweet and chewy texture that is derived from boiling down the parboiled roots of vegetables or fruits with honey. Junkwa is another named jungkwa.

Vegetables that has been used to make junkwa are ginseng, balloon flower roots, ginger, carrots and other vegetables. Junkwa has usually been taken as a favorite food of royal family and noble class and was accompanied with teas. However, western influence on food culture introduced various western snack that led to decrease in the consumption of junkwa[5], and while the western snacks have satisfied the various tastes of consumers through its active development of new products and capability for mass production, junkwa which has a relatively complicated process of production and takes longer time has been produced only through a manual manufacturing by small amounts and is currently unable to satisfy the tastes of consumers[6].

It has been reported that consumers with higher preference for well-being choose korean traditional snacks instead of western snacks and prefer the ones that were made with organically raised ingredients or natural korean medicine ingredients.

While the fresh ginseng is the most consumed among health functional foods currently available[1], junkwa takes only 3% of consumption among the processed foods made with fresh ginseng[7] Previous researches on junkwa produced with ingredients boiled down with addition of sugar content are lotus root junkwa[8][9][10][11][12][13][14] and the research by Cho & Kim[15] that uses electronic rice cooker for convenience to solve the problem of complexity of process and time consuming when producing fresh ginseng junkwa.

In addition, since junkwa is produced with excessive amount of honey or sugar which is not helpful in preventing adult disease, there has been several researches on alternative sweeteners that can take the place of sugar and honey but most of the researches have been concentrated around the use of oligosaccharide[14][15].

There is only one research on the sweeteners which can be an alternative choice for boil liquid of fresh ginseng junkwa by Cho & Kim[13] that used xylitol, oligosaccharide, stevioside, erythritol and studied their effects on the quality.

Also the characteristic of junkwa when tasted is its unique chewiness and clarity and while each of the sweeteners is assumed to affect junkwa's unique taste characteristics in the process of boiling down together with the ingredients, research on this has rarely been done.

Therefore, this research aimed to find the quality characteristics of fresh ginseng junkwa using low calorie sweeteners - xylitol, oligosaccharide, stevioside, erythritol in replace of honey and sugar used to boil down junkwa, and the effects of storage period.

As junkwa has its own unique characteristic of clarity and chewiness, by the examining on the effects of storage period through measuring moisture level, chewiness, and brightness, the research intends to develop korean traditional snack the fresh ginseng junkwa that meets the taste of consumers.

2. Experimental Methods

2.1 Moisture level measurements

Moisture level was measured by putting each 3g of fresh ginseng junkwa through the halogen method(110℃, A60) of the moisture analyser(Moisture Analyzer, MB 45 OHAUS, USA). Each of the samples were measured five times to derive the average.

2.2. Chewiness measurements
After sugaring of the fresh ginseng junkwa, its chewiness were measured using texture analyzer (TA-XT Express, Stable Micro Systems, UK) with 2 mm cylinder probe (Pre-test speed: 3 mm/s, Test speed: 2 mm/s, Post-test speed: 3 mm/s, Distance: 1.5 mm, Time: 3 sec, Trigger Force: 5 g).

2.3. Lightness measurements

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

2.4. Statistical methods

The results of fresh ginseng junkwa’s moisture level, chewiness, lightness 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. Changes in the moisture level of fresh ginseng junkwa

The result of measuring moisture level of the fresh ginseng junkwa that was produced with xylitol, oligosaccharide, stevioside, erythritol and kept in room temperature of 24°C for 12 days is as in the following <Table 1>.

The fresh ginseng junkwa boiled down with sugar, the control group, had 28.60% of moisture level on the first, on the twelfth it was 22.51% that it was found that as time passed the moisture level decreased significantly (p<0.001). The day jungkwa was added with xylitol showed 17.16%, 15.46% on the twelfth day that it showed the decrease in moisture level just as sugar did (p<0.001). Junkwa made with oligosaccharide showed 39.88% on the day it was produced, 39.01% on the third day, 36.21% on the twelfth (p<0.001), and the junkwa made with stevioside showed 60.01% on the first day, when twelve days have passed the moisture level measured was 50.93% (p<0.001). Junkwa made with erythritol showed 22.98% on the day it was produced, 21.52% on the third day, and 16.25% on the after twelve days that as the time went the moisture level significantly decreased (p<0.001). Compared to other samples, xylitol and oligosaccharide junkwa showed less decrease in moisture level, and the junkwa made with stevioside showed much decrease in moisture level compared to the ones made with other sweeteners. This is thought to be due to the difference in the fresh ginseng's ability to retain moisture which depends on the form of bonding formed between ginseng’s free water and crystal of the sweetener.

Therefore, based on the measurement of moisture level, the junkwas that showed the least change in the moisture level from the first day they were produced were the ones made with xylitol and oligosaccharide that they are the most suitable for storage and eating.

Table 1. Changes in moisture level of fresh ginseng junkwa made with different sweetener during storage at 24°C for 12 days.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Storage(Days)</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0</td>
<td>28.60± 0.96*</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>28.57± 1.19*</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>24.62± 1.36*</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>24.16± 1.09*</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>22.51± 1.09*</td>
</tr>
<tr>
<td>Xylitol</td>
<td>0</td>
<td>17.16± 0.48*</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>16.84± 0.29*</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>16.64± 0.36*</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>16.23± 0.19*</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>15.46± 0.12*</td>
</tr>
<tr>
<td>Oligosaccharides</td>
<td>0</td>
<td>39.88± 0.20*</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>39.01± 0.36*</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>37.58± 0.75*</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>36.72± 0.62*</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>36.21± 0.04*</td>
</tr>
<tr>
<td>Stevioside</td>
<td>0</td>
<td>60.01± 0.69*</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>57.57± 1.92*</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>55.80± 0.68*</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>53.95± 0.51*</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>50.93± 0.83*</td>
</tr>
</tbody>
</table>

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3.2. Changes in chewiness of fresh ginseng junkwa

The result of measuring the chewiness of the fresh ginseng junkwas produced with different sweeteners and kept in room temperature of 24°C for 12 days is shown in the following Table 2.

As for the control group the chewiness of the first day of production was 254.49-409.93 on the twelfth day that as time passed the chewiness increased(p<0.001). The junkwa made with xylitol showed 278.63 on the first day, and 392.37 on the twelfth day that as time passed the chewiness gradually increased(p<0.001). Junkwa with oligosaccharide showed 229.70 on the first day, 354.11 on the twelfth day(p<0.001); junkwa with stevioside showed 321.98 on the first day, twelve days the chewiness was 466.62(p<0.001). Junkwa with erythritol showed 251.09 on the first day, and after 12 days it showed 440.57 that after 3 days passed significantly noticeable increase in chewiness was observable in the fresh ginseng junkwa(p<0.001).

Therefore based on the measurement of chewiness change depending on storage period, the sample that showed the least change was junkwa made with oligosaccharide and this was the same result with the measurement of hardness on various periods. Thus it was observed that oligosaccharide is the most suitable for making junkwa and for storage.

### Table 2. Changes in chewiness of fresh ginseng junkwa made with different sweetener during storage at 24°C for 12 days.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Storage(Days)</th>
<th>F- value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control 4)</td>
<td>0  3  6  9  12</td>
<td>***4) 105.792</td>
</tr>
<tr>
<td>254.4± 11.07±</td>
<td>288.22± 8.94± 2.65± 18.50± 5.01±</td>
<td>276.967 ***</td>
</tr>
<tr>
<td>Xylitol 4)</td>
<td>278.63± 4.78± 303.34± 3.17± 330.38± 3.31± 361.45± 3.94± 392.37± 7.15±</td>
<td>617.244 ***</td>
</tr>
<tr>
<td>229.70± 2.94±</td>
<td>269.24± 5.23± 1.62± 2.45± 2.69±</td>
<td>466.62± ***</td>
</tr>
<tr>
<td>Oligosaccharides</td>
<td>321.98± 21.11± 358.11± 7.44± 391.80± 10.22± 419.81± 8.66± 466.62± 5.85±</td>
<td>64.971 ***</td>
</tr>
<tr>
<td>Stevioside</td>
<td>251.09± 7.18± 313.14± 11.58± 368.11± 11.64± 397.26± 6.66± 440.57± 19.77±</td>
<td>108.083 ***</td>
</tr>
<tr>
<td>Erythritol</td>
<td>22.98± 0.03± 21.52± 0.47± 20.38± 0.26± 18.47± 0.17± 16.25± 0.21±</td>
<td>285.492 ***</td>
</tr>
</tbody>
</table>

Note: 1)Control: Ginseng junkwa made by the sugar.
2)Ginseng junkwa made with xylitol, oligosaccharides, stevioside and erythritol
3)Mean±Standard deviation. 4)*** p<0.001, ** p<0.01
4)Means in a row by different superscripts are significantly different at the p<0.05 by Duncan’s multiple range test.

3.3. Changes in lightness of fresh ginseng junkwa

The result of measuring the changes in lightness(L-value) of the fresh ginseng junkwa was produced with different sweeteners and

kept in room temperature of 24°C for 12 days is shown in <Table 3>.

The sample group showed 42.23 of lightness on the first day it was produced, 37.75 on the twelfth day that as time passed the lightness significantly decreased(p<0.001). Junkwa with made with xylitol showed 42.05 on the first day, and 34.98 on the twelfth day that as time passes the lightness gradually decreased(p<0.001). Junkwa with oligosaccharide showed 48.97 on the day of production, 48.68 on the third day, and 46.44 on the twelfth(p<0.001); junkwa with stevioside showed 56.61 on the first day, 51.60 on the twelfth(p<0.001). Junkwa with erythritol showed 53.61 on the first day, and after twelve days it was 50.33 that all the samples showed significant decrease in lightness as time of storage got longer(p<0.001). This can be an effect of decrease in moisture level as time passes that leads to the darkening of the color of junkwa. Kwon & Park[12] also reported that the lightness of junkwa made of balloon flower roots also decreased as the storage period got longer which is similar with the results of our research.

It was observed that compared to other samples, the fresh ginseng junkwa made of oligosaccharide did not show much change in its lightness during the storage.

### Table 3. Changes in lightness of fresh ginseng junkwa made with different sweetener during storage at 24°C for 12 days.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Storage (Days)</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>42.23±0.04</td>
<td>40.92±0.32</td>
</tr>
<tr>
<td>Xylitol</td>
<td>42.05±0.08</td>
<td>40.56±0.17</td>
</tr>
<tr>
<td>Oligosaccharides</td>
<td>48.97±0.03</td>
<td>48.68±0.16</td>
</tr>
<tr>
<td>Stevioside</td>
<td>56.61±0.09</td>
<td>55.92±0.05</td>
</tr>
<tr>
<td>Erythritol</td>
<td>53.91±0.07</td>
<td>53.01±0.03</td>
</tr>
</tbody>
</table>

Note: 1)Control: Ginseng junkwa made by the sugar.
2)Ginseng junkwa made with xylitol, oligosaccharides, stevioside and erythritol
3)Means Standard deviation. 4)*** p<0.001

* Means in a row by different superscripts are significantly different at the p<0.05 by Duncan’s multiple range test.

4. Summary and Conclusion

The result of measuring junkwa’s unique chewiness and clarity by producing fresh ginseng junkwas with sugar, xylitol, oligosaccharide, stevioside, erythritol boil liquid and kept in room temperature of 24°C for 12 days is as follows.

Moisture level of fresh ginseng junkwa shows that as time passed the moisture level significantly dropped in all samples; the samples that showed least change in moisture level were the ones produced with xylitol and oligosaccharide.

Change in chewiness the junkwa made with oligosaccharide showed significantly small change as the storage time passed.

Color of junkwa showed that the yellowness of junkwa made with oligosaccharide does not change much during the 12 days of storage compared to other samples while there was significantly.

Therefore, while there was not a distinct tendency found in moisture level, chewiness, lightness of the fresh ginseng junkwa made with various sweeteners depending on the storage period, the fresh ginseng junkwa
made with oligosaccharide which showed less change in moisture level, chewiness compared to other samples, and less change in lightness measurement is observed to be the best in quality. Thus it was observed that producing junkwa with oligosaccharide instead of sugar can enable the produce of junkwa with low calorie which will meet the health needs of modern day people.

5. Reference

5.1. Journal articles


5.2. Books


5.3. Additional references

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