Quality and Sensory Characteristics of Yanggaeng, a Healthy Snack Added with Pinus Koraiensis Needle Extract Powder for the Elderly

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Abstract
Korea has entered the aged society, with those aged over 65 years accounting for 14–20% of its population. Interest in the quality of life, nutrition, and health of the elderly is increasing. Since the energy intake of the elderly is lower than the estimated required amount, nutrient intake ratio of the elderly is related to mastication. Yanggaeng is a high-energy food made from agar, sugar, and red bean paste. Since it has a soft texture, it is highly utilized as a snack for the elderly who have inconvenience in mastication. Pinus koraiensis needle is known to possess antioxidant and antibacterial effects. The purpose of this study was to develop a functional snack added with Pinus koraiensis needle extract powder known to possess anti-inflammatory, anti-cancer, and antibacterial effects for the elderly that would be easy for them to chew. In this study, yanggaeng was manufactured with 0%, 2%, 4%, 6%, or 8% of Pinus koraiensis needle extract powder, white sediment, and agar. In the experiment, moisture contents, color values texture characteristics, antioxidant activities, and sensory preference results were evaluated. Moisture content was the highest in the group added 6% of the extract powder. It was the lowest in the group added 8% of the extract powder, showing a significant (p < 0.001) difference between the two. Hardness, cohesiveness, and springiness of texture characteristics were decreased significantly (p < 0.001) while the adhesiveness and chewiness of texture characteristics were increased significantly (p < 0.001) as the amount of addition increased. Regarding antioxidative activity measurements, levels of polyphenols were the highest (p < 0.001) in the group added with 8% of the extract powder. DPPH and ABTS radical scavenging activities were increased as the amount of addition increased (p < 0.001). Overall sensory preference was the highest for the 2% addition group. It decreased as the amount of addition increased (p < 0.001). Results of this study indicate that Pinus koraiensis needle extract powder with antioxidant and antibacterial effects can be used to manufacture yanggaeng to make functional snacks with improved quality characteristics for the elderly.

Keywords: pine needle powder, yanggaeng, texture, antioxidant activities, quality characteristics

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1. Introduction

In South Korea, the proportion of the elderly population is continuously increasing. According to United Nations (UN) standards, South Korea has entered an aging society in that the proportion of the population of those aged over 65 years is 14% or more [1]. According to the statistics agency data, the proportion of the total population of those aged over 65 years old in South Korea is showing a gradual increase from 13.3% in 2016 to 14.4% in 2018 and 16.0% in 2020 [2]. Thus, there is a growing interest in the quality of life [3], nutrition [4], and health [5] of the elderly.

According to the 7th Korea National Health and Nutrition Examination Survey, the energy intake of the elderly is lower than the estimated required amount in the food insecurity group. In addition, rates of those having low intakes of vitamin A, vitamin B1, vitamin B2, niacin, vitamin C, calcium, and iron are high in the elderly [6].

The rate of nutrient intake in the elderly is related to mastication [7]. Masticatory inconvenience rate is as high as 39.5% in the elderly [8]. According to a study on characteristics of dietary intake of Korean elderly by chewing ability, more than half of those aged over 65...
years have mastication inconvenience. All nutrients and food intake are significantly lower in the masticatory inconvenience group than in the masticatory convenience group [9]. Also, the frequency of intake was lower for food that was hard, tough, hard to cook, or hard to chew. The frequency of snack intake was significantly lower in the masticatory inconvenience group [9].

According to a study on the demand for food development for the elderly, the taste that the elderly like the best is a light taste. Bread, rice cakes, and beverages were main snacks they wanted and food was selected in consideration of their authoring capability [10]. Therefore, it is necessary to develop snacks with a light taste. They should also be easy to masticate. In addition, nutritional aspects should be considered.

Yanggaeng is a Korean traditional snack. It is a high-energy food made of agar, sugar, and red bean paste [11]. Hancheon is the main ingredient. It can improve fat accumulation and insulin level [12]. It is rich in dietary fiber, which can activate intestinal peristalsis. Thus, it is effective for alleviating constipation [13]. Yanggaeng also has a soft texture. Thus, it is highly utilized as a snack for the elderly with to mastication inconvenience [14].

*Pinus koraiensis* has antioxidant and antibacterial effects [15,16]. *Pinus koraiensis* needle contains astragalin, (+)-catechin juglanin, gallic acid, kaempferol, p-coumaric acid, protocatechuic acid, quercetin, syringic acid, vanillic acid, and so on [17,18]. According to previous studies, *Pinus koraiensis* needle has a strong antioxidant effect due to antioxidant ability of gallic acid and syringic acid as ingredients of *Pinus koraiensis* needle [19,20].

The aim of this study was to develop a functional snack for the elderly that would be easy to chew using pinus koraiensis needle extract powder known to possess anti-inflammatory, anti-cancer, and antibacterial effects. Yanggaeng samples were prepared with 0%, 2%, 4%, 6%, and 8% of *Pinus koraiensis* needle extract powder. Moisture contents, color values, texture characteristics, antioxidant activities, and sensory preference results of these samples were then evaluated.

### 2. Materials and Methods

#### 2.1. Ingredients and Manufacturing

##### 2.1.1. Ingredients

*Pinus koraiensis* needle extract powder was provided by Dain Natural. Other ingredients such as white bean paste (Morning Seoul), agar (Cooknake), sugar (CJ Cheiljedang), salt (Chungjungone), and fructo-oligosaccharide (CJ Cheiljedang) were purchased online.

##### 2.1.2. Yanggaeng Manufacturing

The combination percentage of *Pinus koraiensis* needle extract powder with yanggaeng was standardized as shown in [21]. The combination percentage of *Pinus koraiensis* needle extract powder was 0%, 2%, 4%, 6%, and 8% (Figure 1). Agar (30 g) was placed in water, soaked for 20 minutes, and boiled over a medium heat for about 2 minutes. *Pinus koraiensis* needle extract powder was mixed with 50 g of water, added with white bean paste and sugar, and boiled over low heat for about 2 minutes. After that, add salt and fructo-oligosaccharide, and boil over a low heat for about 2 minutes. Yanggaeng of *Pinus koraiensis* needle extract powder was then placed in a mold to harden it. It was cooled for 3 hours and then used in the experiment.

#### Table 1. Yanggaeng added with different levels of Pinus koraiensis needle extract powder

| Ingredients (g) | Samples |
|----------------|---------|
| White bean paste | YP0 300 YP1 294 YP2 288 YP3 282 YP4 276 |
| Pinus Koraiensis needle extract powder | 0 2 4 6 8 |
| Water | 240 240 240 240 240 |
| Sugar | 30 30 30 30 30 |
| Fructo-oligosaccharide | 30 30 30 30 30 |
| Agar | 6 6 6 6 6 |
| Salt | 1 1 1 1 1 |

1YP0: Yanggaeng with 0% *Pinus koraiensis* needle extract powder
2YP1: Yanggaeng with 2% *Pinus koraiensis* needle extract powder
3YP2: Yanggaeng with 4% *Pinus koraiensis* needle extract powder
4YP3: Yanggaeng with 6% *Pinus koraiensis* needle extract powder
5YP4: Yanggaeng with 8% *Pinus koraiensis* needle extract powder

#### Figure 1. Yanggaeng added with Pinus Koraiensis needle extract powder

1YP0: Yanggaeng with 0% *Pinus koraiensis* needle extract powder
2YP1: Yanggaeng with 2% *Pinus koraiensis* needle extract powder
3YP2: Yanggaeng with 4% *Pinus koraiensis* needle extract powder
4YP3: Yanggaeng with 6% *Pinus koraiensis* needle extract powder
5YP4: Yanggaeng with 8% *Pinus koraiensis* needle extract powder

### 2.2. Experimental Methods

#### 2.2.1. Moisture Contents and Color Values

Moisture content was determined after placing 3 g of each sample in a drying oven (LO-FS150, LK Lab, Korea) at 105°C for one hour. An atmospheric pressure heating and drying method was used in accordance with the AOAC method [22], which could repeatedly performing cooling in desiccators (ADC47, LK Lab, Korea) for 30 minutes. The experiment was carried out in triplicate and shown as an average value. Color values including L-value, a-value, and b-value were measured with a chromaticity meter. The measurement was carried out in triplicate and shown as an average value. Before measuring the chromaticity, a standard white plate (Calibration plate CR-A43) was used to calibrate the chromaticity meter with L-value of 93.00, a-value of 0.3125, and b-value of 0.2531.

#### 2.2.2. Texture Characteristics

Texture characteristics including hardness, adhesiveness, chewiness, cohesiveness, and springiness were measured using a CTX Texture analyzer (Ametek Brookfield, USA) for TPA (Texture Profile Analysis). The experiment was
carried out in triplicate and shown as an average value. Measurement conditions of the CTX Texture analyzer are shown in Table 2.

| Measuring | Condition |
|-----------|-----------|
| Trigger force | 10 g |
| Sample compressed | 25% |
| Sample height | 20 mm |
| Test speed | 10 mm/s |
| Sample diameter | 30 mm |

2.2.3. Antioxidative Activity Measurement

Total polyphenol content was measured referring to a previous study by [23]. Briefly, 0.4 mL of Folin-Ciocalteu reagent and 0.2 mL of distilled water were mixed with 0.2 mL of the sample and left at room temperature for 5 minutes. After adding 0.4 mL of 10% sodium carbonate, the mixture was allowed to stand at room temperature for 30 minutes. The absorbance was then measured at 765 nm with a spectrophotometer (UV-1800, Shimadzu, Nishinokyo Kuwabara-cho, Nakagyo-ku, Kyoto, Japan). The experiment was carried out in triplicate and shown as an average value. Total polyphenol content results are expressed as mg GAE/L.

DPPH radical scavenging capacity was determined referring to a previous study by [24]. Briefly, 0.9 mL of 0.2 mM DPPH solution was mixed with 0.1 mL of sample extract, reacted for 30 minutes, and then the absorbance was measured at 517 nm. The experiment was carried out in triplicate and shown as an average value.

ABTS radical scavenging capacity was determined referring to a previous study by [25]. Briefly, 7.4 mM ABTS solution and 2.7 mM potassium persulfate solution were mixed at 1:1 and left unattended for 14 hours. ABTS cations were formed and diluted with 50% methanol so that the absorbance value was 0.7 to 1.0 at 734 nm. Diluted ABTS (1.0 mL) solution and 100 μL of sample were mixed and reacted for 10 minutes. Absorbance was then measured at 734 nm. The experiment was carried out in triplicate and shown as an average value.

2.2.4. Sensory Preference

Sensory preference was determined after sufficiently explaining the purpose of the experiment and the method of evaluating sensual characteristics to 15 food-related workers (Eulji University Institutional Bioethics Committee Deliberation Exemption Approval Number: EU21-058). A certain amount of the sample was put in a container without color or aroma and served with a spoon and additive table of triple-digit. Before a preference test was performed, the mouth was rinsed with water after eating one sample. Sensory preference results were Color, Flavor, Taste, Texture, and Overall preference. Each characteristic was shown to have a stronger preference as the number increased using a 7-point scale.

2.2.5. Statistical Analysis

All statistical analyses were performed using SPSS 22.0 package (Ver. 22.0 for window, Chicago, IL, U.S.A.). Experimental data are expressed as mean ± standard error of the mean obtained from experiments carried out in triplicate. Significance was determined using post LSD test of one-way ANOVA. Significant differences among means of samples were set at \( p < 0.05 \).

3. Results and Discussion

3.1. Moisture Contents and Color Values of Yanggaeng

Table 3 shows results of moisture contents and color values of Yanggaeng added with Pinus Koraiensis needle extract powder. Moisture content was 48.27% for the control group, 50.33% for the 2% addition group, 47.83% for the 4% addition group, 52.00% for the 6% addition group, and 44.75% for the 8% addition group. It was the highest in the 6% addition group and the lowest in the 8% addition group, showing a significant \( p < 0.001 \) difference between the two. L-value was 52.22 in the control group, 36.12 in the 2% addition group, 34.64 in the 4% addition group, 36.13 in the 6% addition group, and 33.66 in the 8% addition group, with the control group having a higher L-value than the addition group. The 8% addition group had the lowest L-value. These values were significantly \( (p < 0.001) \) different. Regarding the a-value, it was -1.30 in the control group, -1.89 in the 2% addition group, -1.40 in the 4% addition group, -1.45 in the 6% addition group, and -1.16 in the 8% addition group. The 2% addition group had the highest a-value and the 8% addition group had the lowest a-value, showing a significant \( (p = 0.003) \) difference. For b-value of color value, it was 4.73 in the control group, 13.56 in the 2% addition group, 12.63 in the 4% addition group, 12.79 in the 6% addition group, and 10.70 in the 8% addition group. The 2% addition group had the highest b-value and the 8% addition group had the lowest b-value, showing a significant \( (p < 0.001) \) difference between the two.

| Sample | Moisture contents (%) | Color value |
|--------|-----------------------|------------|
|        | L                     | a          | b          |
| YP0    | 48.27±0.24\(^1\)      | 52.22±0.10\(^2\) | -1.30±0.07\(^3\) | 4.73±0.08\(^4\) |
| YP1    | 50.33±0.20\(^1\)      | 36.12±0.55\(^2\) | -1.89±0.10\(^3\) | 13.56±0.20\(^4\) |
| YP2    | 47.83±0.23\(^1\)      | 34.64±0.10\(^2\) | -1.40±0.08\(^3\) | 12.63±0.12\(^4\) |
| YP3    | 52.00±0.22\(^1\)      | 36.13±0.09\(^2\) | -1.45±0.12\(^3\) | 12.79±0.23\(^4\) |
| YP4    | 44.75±0.28\(^1\)      | 33.66±0.31\(^2\) | -1.16±0.09\(^3\) | 10.70±0.86\(^4\) |

\(^{1}\) L: lightness, \( a \): redness, \( b \): yellowness
\(^{2}\) Values are presented as mean ± S.E. (Standard Error)
\(^{3}\) Tested by ANOVA (Analysis of Variance) method.
\(^{4}\) Means in a column with different superscripts are significantly different at 5% significance level by LSD.

In this study, except for 6%, moisture contents decreased significantly as the amount of addition increased. A Moringa leaf powder yanggaeng [26] study and a dropwort powder yanggaeng [27] study also showed that color values were decreased significantly as the amount of addition increased. On the other hand, a study on Barley sprout powder and Finger Root powder...
In this study, hardness, cohesiveness, and springiness values were significantly decreased whereas adhesiveness and chewiness values were significantly increased as the amount of addition increased. A black ginger study showed that hardness and springiness were significantly increased while the adhesiveness was significantly decreased as the amount of addition increased [32]. In case of Yam powder yanggaeng, its hardness, cohesiveness, and springiness were significantly decreased as the amount of addition increased [29]. In a black ginger yanggaeng study, hardness is made difference of moisture contents that subsidiary materials ownself water binding power get high absorptivity of water [32]. According to a previous study on preparation and characterization of gel food for elderly, the elderly preferred gel-type foods that were not too hard, having elasticity that could be chewed, and having low adhesion [33]. Accordingly, Pinus koraiensis needle extract powder yanggaeng in this study is considered to be suitable for the palatability of the elderly.

### 3.3. Antioxidative Activity Measurement of Yanggaeng

Table 5 shows results of antioxidative activity measurement of Yanggaeng added with *Pinus Koraiensis* needle extract powder. The polyphenol content was 8.02 mg/mL in the control group, 17.18 mg/mL in the 2% addition group, 13.92 mg/mL in the 4% addition group, 33.38 mg/mL in the 6% addition group, and 46.35 mg/mL in the 8% addition group. The 8% addition group had the highest ($p < 0.001$) polyphenol content. DPPH radical scavenging activity was 3.17% in control group, 17.77% in 2% addition group, 31.56% in 4% addition group, 39.02% in the 6% addition group, and 433.59% in the 8% addition group. It was increased ($p < 0.001$) as the amount of addition increased. ABTS radical scavenging activity was 3.58% in control group, 36.05% in 6% addition group, 41.44% in 4% addition group, 43.97% in 6% addition group, and 48.22% in 8% addition group. It was increased ($p < 0.001$) as the amount of addition increased.

In this study, polyphenol increased significantly as the amount of addition increased except for the 4% addition level. ABTS and DPPH radical scavenging activities were also increased significantly as the amount of addition increased.

| Samples | Hardness (g) | Adhesiveness (mJ) | Chewiness (mJ) | Cohesiveness (%) | Springiness (mm) |
|---------|-------------|-------------------|----------------|------------------|-----------------|
| YP0     | 1733.57±13.32a | 4.36±0.01a         | 31.99±0.39a     | 0.50±0.01a       | 4.66±0.02cd     |
| YP1     | 1706.70±5.31a | 4.51±0.01a         | 37.86±0.75a     | 0.38±0.01ab      | 4.62±0.01bcd    |
| YP2     | 1537.03±4.59a | 4.82±0.09a         | 41.18±0.50a     | 0.37±0.01ab      | 4.53±0.01bcd    |
| YP3     | 1378.40±5.96a | 5.56±0.00a         | 44.07±0.43a     | 0.37±0.00ab      | 4.52±0.01ab     |
| YP4     | 1276.13±13.66a | 5.65±0.02a         | 47.50±0.45a     | 0.36±0.01ab      | 3.80±0.09a      |
| $p$-value | <0.001         | <0.001             | <0.001          | <0.001           | <0.001          |

1) Values are presented as mean ± S.E. (Standard Error)
2) Tested by ANOVA (Analysis of Variance) method.
3) Means in a column by different superscripts are significantly different at 5% significance level by LSD.
4) Each value is presented as mean ± S.E. of three times.
Table 5. Total polyphenol and antioxidant activities of Yanggaeng added with Pinus Koraiensis needle extract powder

| Sample | Polyphenol (mg/mL) | DPPH (%) | ABTS (%) |
|--------|--------------------|----------|----------|
| YP0    | 8.02±0.02a         | 3.17±0.08a | 3.58±0.07a |
| YP1    | 17.18±0.18b        | 17.77±0.99b | 36.05±1.32b |
| YP2    | 13.92±0.07b        | 31.56±0.60c | 41.44±0.75c |
| YP3    | 33.37±0.20d        | 39.02±0.12c | 43.97±0.51c |
| YP4    | 46.35±0.03e        | 43.59±0.49d | 48.22±0.91e |

*p*-value <0.001 <0.001 <0.001

1) DPPH: α, α’-diphenyl-β-picrylhydrazyl, ABTS: 2,2’-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid)
2) Values are presented as mean ± S.E. (Standard Error)
3) Tested by ANOVA (Analysis of Variance) method.
4) a-d Means in a column by different superscripts are significantly different at 5% significance level by LSD.
5) Each value is presented as mean ± S.E. of 3 times.

In addition, a study on Lycii fructus extract yanggaeng [34] and a study on moringa leaf powder yanggaeng [26] showed that polyphenol content and DPPH and ABTS radical scavenging activities were increased significantly as the amount of addition increased. Pinus koraiensis needle has ingredients such as astragalin, (+)-catechin juglanin, gallic acid, kaempferol, p-coumaric acid, protocatechuic acid, quercetin, syringic acid, vanillic acid, and so on [17,18].

3.4. Sensory Preference Results of Yanggaeng

Table 6 shows results of sensory preference for Yanggaeng added with Pinus Koraiensis needle extract powder. The color was 3.07 in control group, 5.00 in the 2% addition group, 4.73 in the 4% addition group, 4.53 in the 6% addition group, and 4.40 in the 8% addition group. The 2% addition group had the highest color value. The color value (p = 0.006) was significantly decreased as the amount of addition increased. The flavor value was 2.67 in control group, 4.07 in 2% addition group, 4.40 in the 4% addition group, 3.80 in the 6% addition group, and 3.27 in the 8% addition group. The 4% addition group had the highest flavor value while the 8% addition group had the lowest flavor value. They showed no significant difference. The texture value was 3.47 in control group, 3.60 in the 2% addition group, 3.73 in the 4% addition group, 3.47 in the 6% addition group, and 3.33 in the 8% addition group. The 4% addition group had the highest texture value while the 8% addition group had the lowest texture value. They showed no significant difference between the two. Overall preference was 3.53 in control group, 3.80 in the 2% addition group, 3.20 in the 4% addition group, 2.33 in the 6% addition group, and 1.67 in the 8% addition group. It was significantly (p < 0.001) increased as the amount of addition increased.

In this study, the 8% addition group had the lowest flavor, texture, and taste, although they did not show a significant difference. Color and overall preference values were the highest in the 2% addition group. They were significantly decreased as the amount of addition increased. In the case of mugwort powder yanggaeng, color value was the highest in the 2% addition group. The overall preference was also the highest in the 2% addition group [35]. In the case of dropwort powder yanggaeng, color was high in the 1% and the 2% addition group. Overall preference was the highest in the 2% addition group [27]. Thus, preference of yanggaeng that made strong scented subsidiary materials significantly decreased as the amount of addition increased.

Table 6. Sensory preference results of Yanggaeng added with Pinus Koraiensis needle extract powder

| Sample | Color  | Flavor  | Texture | Taste  | Overall preference |
|--------|--------|---------|---------|--------|--------------------|
| YP0    | 3.07±0.47a | 2.67±0.44 | 3.47±0.26 | 3.00±0.45 | 3.53±0.45ab |
| YP1    | 5.00±0.43b  | 4.07±0.50 | 3.60±0.34 | 3.93±0.49 | 3.80±0.44cd |
| YP2    | 4.73±0.27b  | 4.40±0.36 | 3.73±0.18 | 3.67±0.44 | 3.20±0.31bc |
| YP3    | 4.53±0.22b  | 3.80±0.47 | 3.47±0.22 | 2.93±0.49 | 2.33±0.33bc |
| YP4    | 4.40±0.45b  | 3.27±0.57 | 3.33±0.23 | 2.47±0.58 | 1.67±0.23b  |

*p*-value 0.006 0.094 0.828 0.228 <0.001

1) Values are presented as mean ± S.E. (Standard Error)
2) Tested by ANOVA (Analysis of Variance) method.
3) a-d Means in a column by different superscripts are significantly different at 5% significance level by LSD.
4) Each value is presented as mean ± S.E. of 3 times.
4. Conclusion

This study was performed in an attempt to develop a functional snack for the elderly that would be easy to chew using *Pinus koraiensis* needle extract powder known to possess anti-inflammatory, anti-cancer, and antibacterial effects. Yanggaeng was prepared with 0%, 2%, 4%, 6%, or 8% of pinus koraiensis needle extract powder. Moisture contents, color value, texture characteristics, antioxidant activities, and sensory preference were evaluated. Moisture content was the highest in the 6% addition group and the lowest in the 8% addition group, showing a significant (p < 0.001) difference between the two. The L-value of color value in the control group was higher than that of the addition group. The 8% addition group had the lowest L-value. They showed a significant difference (p < 0.001). The a-value of color value was the highest in the 2% addition group and the lowest in the 8% addition group. They showed a significant (p = 0.003) difference. The b-value of color value was the highest in the 2% addition group. It was the lowest in the 8% addition group. They showed a significant difference (p < 0.001).

The hardness, cohesiveness, and springiness of texture characteristics were decreased significantly as the amount of addition increased (p < 0.001). However, the adhesiveness and chewiness of texture characteristics analyses showed increases significantly as the amount of addition increased (p < 0.001). Polyphenol content in the antioxidative activity measurement showed that the 8% addition group had the highest polyphenol content (p < 0.001). DPPH and ABTS antioxidative activities were increased significantly (p < 0.001) as the amount of addition increased. Color value of sensory preference results showed the 2% addition group had the highest color value. It decreased as the amount of addition increased (p = 0.006). Flavor and texture of sensory preference results showed the 4% addition group was the highest while the 8% addition group was the lowest. They did not show a significant difference. Sensory preference results showed the 2% addition group had the highest preference while the 8% addition group had the lowest. They did not show a significant difference. Overall preference of sensory preference results showed the 2% addition group had the highest preference. The preference decreased as the amount of addition increased (p < 0.001).

The elderly that more than half of those aged over 65 years have mastication inconvenience [9]. They have low energy intake, nutrient intake, and high preference for light taste [10]. So, it is necessary to develop snacks that are light taste, easy to chew, nutritional. Yanggaeng is high-energy food, has a soft texture, and is highly utilized as a snack for the elderly with to mastication inconvenience [14]. Also, it is a Korean traditional snack [32] that is familiar to the elderly, and is thought to be less repulsive.

As a results, It is judged that there is a possibility of developing it as an easy to chewing and familiar snack for the elderly to improved antioxidability with pinus koraiensis needle extract powder.

Based on results of this study, supplementation with *Pinus koraiensis* needle extract powder could be used to prepare functional snacks for the elderly due to antioxidant and antibacterial effects of *Pinus koraiensis* needle extract powder, thus improving the quality characteristics of yanggaeng during manufacturing.

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Conflict of Interests

The authors declare that they have no competing interests.

References

[1] Kim, S.W, Direction of Consumer Policy for the Elderly: Focusing on consumer alienation, *Journal of consumer policy studies*, 50 (3): 127-154, 2019.
[2] National Statistical Office, “Population, households and housing units,” National Statistical Office, 2021. [Online]. Available: https://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_11N1502&conn_path=12, [Accessed Sep, 20, 2020].
[3] Hong, S.I, An analysis of the quality of life and the affecting factors of the elderly, *Journal of Family and Economic Issues*, 20 (1): 89-108, 2016.
[4] Ham, S.W, Kim, K.H, Evaluation of the dietary quality and nutritional status of elderly people using the nutrition quotient for elderly (nq-e) in seoul, *J Nutr Health*, 53 (1): 68-82, 2011.
[5] Kim, T.H, Chung, T.Y, Lee, H.B, Implementation of an ondM2M-based health monitoring platform for older adults, *Journal of Digital Contents Society*, 22 (9): 1451-1458, 2021.
[6] Maeng, A.R, Lee, J.H, Yoon, E.J, Health and nutrition intake status of the Korean elderly according to their food security level: data from the 7th Korea national health and nutrition examination survey (knhanes VII), 2016-2018, *J Nutr Health*, 54 (2): 179-198, 2021.
[7] Jang, E.H, Hwang, S.Y, Kim, J.H, Kim, S.J, Yang, Y.J, Comparison of nutritional status according to oral health of the elderly: using data from the 2015 Korea national health and nutrition examination survey, *J Korean Soc Food Sci Nutr*, 50 (5): 531-541, 2021.
[8] Kim, S.H, Effects of nutrient intake on oral health and chewing difficulty by age group, *Journal of the Korea Academia-Industrial-Universal*, 19 (2): 202-209, 2018.
[9] Park, J.E, AN, H.J, Jung, S.U, Lee, Y.N, Kim, C.I, Jang, Y.A, Characteristics of the dietary intake of Korean elderly by chewing ability using data from the korea national health and nutrition examination survey 2007-2010, *J Nutr Health*, 46 (3): 285-295, 2013.
[10] Lee, G.Y, Han, J.A, Demand for elderly food development: relation to oral and overall health focused on the elderly who are using senior welfare centers in seoul, *J Korean Soc Food Sci Nutr*, 44 (3): 370-378, 2015.
[11] Han, E.J, Kim, J.M, Quality Characteristics of Yanggaeng Prepared with Different Amounts of Ginger Powder, *J East Asian Soc Dietary Life* 21 (3): 360-366, 2011.
[12] Park, J.J, Kim, J.E, Yun, W.B, Lee, M.L, Chi, J.Y, Song, B.R, Kim, D.S, Lee, C.Y, Lee, H.S, Lim, Y, Jung, M.W, Hwang, D.Y, Hypolipidemic and hypoinsulimemic effects of dietary fiber from agar in C57BL/6N mice fed a high-fat diet, *Journal of Life Science*, 27 (8): 937-944, 2017.
[13] Jeon, S.W, Hong, C.O, Kim, D.S, Quality characteristics and storage stability of yanggaengs added with natural coloring ingredients. *J Res Inst Eng Technol*, 12: 19-34, 2005.
[14] Yoon, H.S., Jeong, E.J., Kwon, N.R., Kim, I.J., Hong, S.T., Kang, H.J., Eom, H.J. Quality characterization of yanggaeng added with jujube extracts, *Korean J Food Nutr*, 31 (6): 883-889, 2018.

[15] Kim, H. S., Jung, B. O., Lee, S. B., & Chung, S. J. Antioxidant and antibacterial activities of pinus koraiensis extracts with chitosan. *Journal of Chitin and Chitosan*, 17(4): 221-228, 2012.

[16] Cho, Y.J. Inhibitory effect of koreainis chinensis leaves extract on proinflammatory responses in lipopolysaccharide-induced raw 264.7 cells, *J Appl Biol Chem*, 60 (3): 191-198, 2017.

[17] Bae, B.H., Kim, Y.O. Effect of leaf aqueous extracts from some gymnosperm plant on the seed germination, seeding growth and transplant of Hibiscus syriacus varieties, *Korean J Ecol*, 26 (1): 37-47, 2003.

[18] Kim, J.E., Kim, W.Y., Kim, J.W., Park, H.S., Lee, S.H., Lee, S.Y., Kim, M.J., Kim, A.R., Park, S.N. Antibacterial, antioxidative activity and component analysis of pinus koraiensis leaf extracts, *J Soc Cosmet Scientists*, 36 (4): 303-314, 2010.

[19] Lee, M.H., Jeong, J.H., Oh, M.J. Antioxidative activity of gallic acid in acorn extract. *J Korean Soc Food Nutr*, 21 (6): 693-700, 1992.

[20] Heilmann, J., Calis, I., Kirmizibekmez, H., Schuhly, W., Harput, S., Sticher, O. Radial Scavenger activity of phenylethanoid glycosides in FMLP stimulated human polymorphonuclear leukocytes; Structure activity Relationships, *Planta Med*, 66 (8): 746-748, 2000.

[21] Hasegawa, H., Chung, N.Y., Shin, M.H. Quality evaluation of yanggaeng added with job’s tear powder, *Foodservice Industry Journal*, 17 (1): 181-191, 2021.

[22] AOAC. Insoluble and soluble dietary fiber in food—enzymatic gravimetric method MES-TRIS buffer, *Official Methods of Analysis*, 16th edn, 1995.

[23] Zocklein, B.W., Fugelsang, K.C., Gump, B.H., Nury, F.S. Production Wine Analysis, SpringerVerlag, German, 129-168, 1990.

[24] Kang, Y.H., Park, Y.K., Lee, G.D. The nitrite scavenging and electron donating ability of phenolic compounds, *Korean J Food Sci*, 28(2): 232-239, 1996.

[25] Verzelloni, E., Tagliazucchi, D., Conte, A. Relationship between the antioxidant properties and the phenolic and flavonoid content in traditional balsamic vinegar, *Food Chemistry*, 105 (2): 564-571, 2007.

[26] Jhee, O.K. Quality characteristics of the yanggaeng made by moringa (moringa oleifera lam.) leaf powder, *Culinary Science & Hospitality Research*, 26 (1): 93-101, 2020.

[27] Oh, K.C. Quality characteristics of dropwort powder added yanggaeng, *The Korean Journal of Culinary Research*, 21 (6): 291-302, 2015.

[28] Chung, N.Y., Chae, K.Y., Ryu, S.I. Quality evaluation of yanggaeng added with barley sprout powder and finger root powder, *Foodservice Industry Journal*, 17 (1): 205-216, 2021.

[29] Hwang, S.J. Antioxidant activities and quality characteristics of yanggaeng added with yam (dioscorea japonica thunb) powder, *Culinary Science & Hospitality Research*, 27 (4): 178-188, 2021.

[30] Lee, W.H., Hwang, H.J. A Study on the antioxidant activities and calorie of jerusalem artichoke powder-added yanggaeng, *Foodservice industry Journal*, 17 (2): 87-97, 2021.

[31] Kim, A.J., Han, M.R., Lee, S.J. Antioxidative capacity and quality characteristics of yanggaeng using fermented red ginseng for the elderly, *Korean J Food&Nutr*, 50 (7): 715-724, 2021.

[32] Kwon, G.H., Kim, M.H., Han, Y.S. Quality characteristics and antioxidant activity of yanggaeng added with black ginger (Kaempferia parviflora), *J Korean Soc Food Sci Nutr*, 50 (7): 715-724, 2021.

[33] Han, J.S., Han, J.A. Preparation and characterization of gel food for elderly, *Korean J Food Sci Technol*, 46 (5): 575-580, 2014.

[34] Seo, E.J., Kim, A.J., Rho, J.O. Antioxidant effects and storage stability of yanggaeng supplemented with lycii fructus extract, *Korean Journal of Human Ecology*, 25 (3): 375-386, 2016.

[35] Choi, E.K., Kim, S.L., Kim, S.H. Quality characteristics of yanggaeng by the addition of green tea powder, *J East Asian Soc Dietary Life*, 20 (3): 415-422, 2010.