

# Effects of adding green grape juice on sensory characteristics of konjac jelly

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## Introduction

Jelly is a semisolid food in a gel form, which is attracting attention as a food for infants and seniors. Gelling agents for jelly are pectin, agar, gelatin, konjac, and carrageenan. Konjac among them, which contains lots of glucomannan, is a low-calorie food with 6 kcal per 100 g and is much used as a gelling agent for jellies. Fruits used in making jelly are strawberry, peach, orange and grape. Fruit jelly containing vitamin C and dietary fiber can be taken as healthful snack. Green grape is widely used as material for wine and juice. Green grape containing abundant citric acid and organic acid is known to help recover from fatigue. Also it has ever been reported to have antioxidant, anticancer, and antiasthmatic activity. This study examined the sensory characteristics of konjac jelly containing green grape juice (GJ). Konjac jellies were prepared with different concentrations (0%, 25%, 50%, 75%, and 100%) of GJ and their generic descriptive analysis and consumer acceptance test were examined.

## Materials and Methods

### Preparation of jelly

#### Materials

Green grape(Chile), konjac power(MSC Co., Ltd., Yangsan, Korea), white sugar(Samyang Co., Ltd., Ulsan, Korea)

Table 1. Formulas for manufacturing jelly

Sample <sup>1)</sup>	Ingredient (g)			
	Green grape juice	Water	Konjac powder	White sugar
Control	0	300	5	15
GJ25	75	225	5	15
GJ50	150	150	5	15
GJ75	225	75	5	15
GJ100	300	0	5	15

<sup>1)</sup> GJ0: Jelly without green grape juice; GJ25: Jelly containing green grape juice 25%; GJ50: Jelly containing green grape juice 50%; GJ75: Jelly containing green grape juice 75%; GJ100: Jelly containing green grape juice 100%.

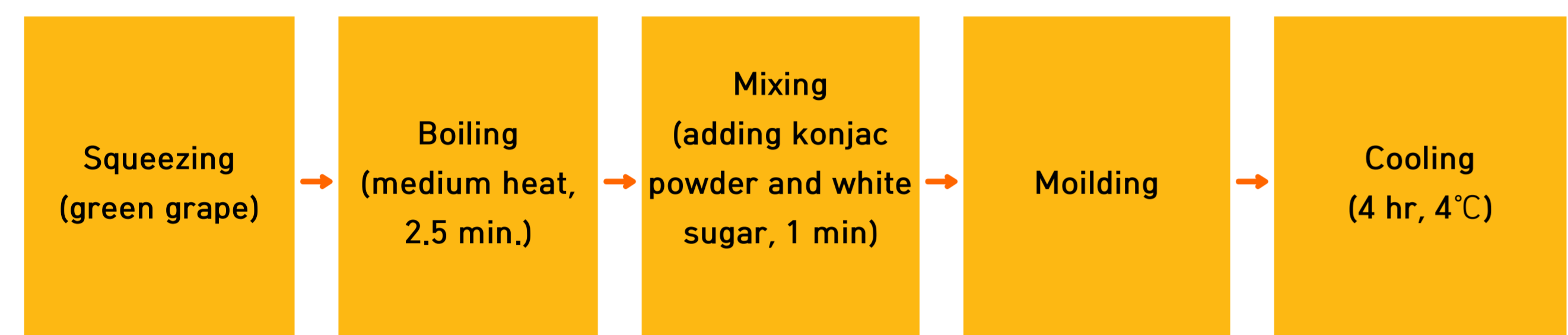


Fig. 1. Preparation process for jelly.

### Sensory evaluation

#### Generic descriptive analysis

- 8 trained panelists
- 15 cm unstructured line scale (0 cm: Extremely weak - 15 cm: Extremely strong)
- Table 2

#### Acceptance test

- 100 consumers
- 9-point hedonic scale (1: Extremely dislike - 9: Extremely like)
- Color, aroma, flavor, texture, overall acceptability

### Statistic analysis

- SPSS(ver. 24)
- ANOVA, Duncan's multiple range test( $p < 0.05$ )
- SAS (ver. 9.2)
- Principal component analysis (PCA)

Table 2. Sensory attributes, definitions, and physical standards of jelly samples

Attribute	Definition	Physical standard	Sample size	Scale value
<b>Appearance</b>				
Transparency	Degree of being clear and transparent	Munsell color system(10YR)(OSA, Washington, D.C, USA)	Color print	10
Yellowness	Degree of yellow color clarity	Isotonic drink(Donga-otsuka. CO., Ltd., Cheongju, Korea)	50 mL	4
<b>Aroma</b>				
Sweet	Intensity of aroma associated with typical sucrose in fruits	Canned peach(P.PAVLIDES S.A., Yanitsa, Greece)	20 g	13
Metallic	Intensity of odor associated with iron in tap water	Water(Tap water)	50 mL	8
Grassy	Intensity of odor associated with freshly cut grass	Balsam paste(powder 1.5 g + water 3 g) Balsam powder(Eye-on, Namyangju, Korea)	4.5 g	13
<b>Taste/Flavor</b>				
Sweetness	Intensity of fundamental taste sensation associated with typical sucrose	5% Sucrose solution	50 mL	7
Sourness	Intensity of fundamental taste sensation of citric acid solution or vinegar	Green grape(Chile)	12 g	10
Green grape skin	Intensity of taste sensation associated with green grape skin	Green grape(Chile)	12 g	14
<b>Texture/Mouthfeel</b>				
Hardness	Force required to break the sample between the molars in the first bite	Kororo jelly(muscat)(UHA Mikakuto Co., Ltd., Osaka, Japan)	2 pieces	5
Gumminess	Energy required to disintegrate the sample to a state ready for swallowing	Jelly in Cocopalim(HAITAIhtb. Co., Ltd., Cheonan, Korea)	10 g	10
Astringency	Intensity of complex feeling in the mouth associated with the presence of tannins	Sample GJ50(Providing no information about the sample)	1.5 cm cube	7.5

## Results

Table 3. Generic descriptive sensory evaluation of jelly

Attribute	Sample <sup>1)</sup>					F-value
	Control	GJ25	GJ50	GJ75	GJ100	
<b>Appearance</b>						
Transparency	10.69±4.01 <sup>a</sup>	6.31±2.53 <sup>b</sup>	4.47±1.95 <sup>c</sup>	4.01±2.76 <sup>c</sup>	3.85±3.38 <sup>c</sup>	21.78***
Yellowness	1.12±0.81 <sup>c</sup>	5.85±2.78 <sup>b</sup>	9.54±2.04 <sup>a</sup>	10.25±1.72 <sup>a</sup>	10.65±1.64 <sup>a</sup>	107.54***
<b>Aroma</b>						
Sweet	2.47±1.78 <sup>d</sup>	5.72±2.51 <sup>c</sup>	8.08±2.52 <sup>b</sup>	8.44±3.01 <sup>b</sup>	9.90±2.35 <sup>a</sup>	33.53***
Metallic	3.23±2.23 <sup>a</sup>	4.81±2.83 <sup>a</sup>	6.42±2.79 <sup>a</sup>	10.35±18.24 <sup>a</sup>	7.42±3.29 <sup>a</sup>	2.40
Grassy	4.04±4.00 <sup>c</sup>	5.95±2.93 <sup>b</sup>	8.57±2.79 <sup>a</sup>	5.83±2.84 <sup>a</sup>	9.59±2.43 <sup>a</sup>	13.51***
<b>Taste/Flavor</b>						
Sweetness	5.04±2.97 <sup>d</sup>	7.15±2.64 <sup>c</sup>	9.13±2.56 <sup>b</sup>	9.81±2.48 <sup>ab</sup>	11.21±1.61 <sup>a</sup>	22.47***
Sourness	2.27±2.03 <sup>d</sup>	5.30±2.52 <sup>c</sup>	7.69±2.82 <sup>b</sup>	8.35±2.62 <sup>ab</sup>	9.57±2.07 <sup>a</sup>	33.98***
Green grape skin	1.57±1.16 <sup>c</sup>	5.51±2.88 <sup>b</sup>	7.67±3.31 <sup>a</sup>	8.35±3.43 <sup>a</sup>	9.20±3.68 <sup>a</sup>	24.39***
<b>Texture/Mouthfeel</b>						
Hardness	9.76±2.37 <sup>a</sup>	8.66±2.44 <sup>a</sup>	7.95±2.09 <sup>a</sup>	8.26±2.12 <sup>a</sup>	8.09±2.55 <sup>a</sup>	2.39
Gumminess	9.15±2.20 <sup>a</sup>	8.38±2.28 <sup>a</sup>	8.33±2.06 <sup>a</sup>	8.18±2.39 <sup>a</sup>	8.41±2.55 <sup>a</sup>	0.65
Astringency	1.65±1.03 <sup>c</sup>	4.49±2.10 <sup>b</sup>	6.31±2.49 <sup>a</sup>	6.76±2.72 <sup>a</sup>	7.58±2.70 <sup>a</sup>	25.43***

Data represents Mean±S.D. Values with same superscripts in a row are not significantly each other at  $p < 0.05$  by the Duncan's multiple range test. \*\*\*  $p < 0.001$ . <sup>1)</sup> Refer to the Table 1.

Table 4. Acceptance test of jelly

Attribute	Sample <sup>1)</sup>					F-value
	Control	GJ25	GJ50	GJ75	GJ100	
Color	5.83±1.82 <sup>a</sup>	5.53±1.52 <sup>ab</sup>	5.09±1.56 <sup>b</sup>	4.40±1.75 <sup>c</sup>	4.23±1.54 <sup>c</sup>	17.83***
Aroma	4.65±1.08 <sup>a</sup>	4.25±1.65 <sup>a</sup>	4.78±1.64 <sup>a</sup>	4.46±1.81 <sup>a</sup>	4.25±1.65 <sup>a</sup>	2.24
Flavor	3.33±1.45 <sup>b</sup>	3.02±1.58 <sup>b</sup>	4.37±1.77 <sup>a</sup>	4.36±1.92 <sup>a</sup>	4.06±1.98 <sup>a</sup>	12.47***
Texture	4.74±1.69 <sup>a</sup>	5.06±1.73 <sup>a</sup>	5.24±1.82 <sup>a</sup>	4.95±1.70 <sup>a</sup>	4.65±1.74 <sup>a</sup>	1.89
Overall acceptability	3.96±1.55 <sup>bc</sup>	3.59±1.71 <sup>c</sup>	4.58±1.84 <sup>a</sup>	4.37±1.89 <sup>ab</sup>	4.15±1.71 <sup>ab</sup>	4.78**

Data represents Mean±S.D. Values with same superscripts in a row are not significantly each other at  $p < 0.05$  by the Duncan's multiple range test. \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ . <sup>1)</sup> Refer to the Table 1.

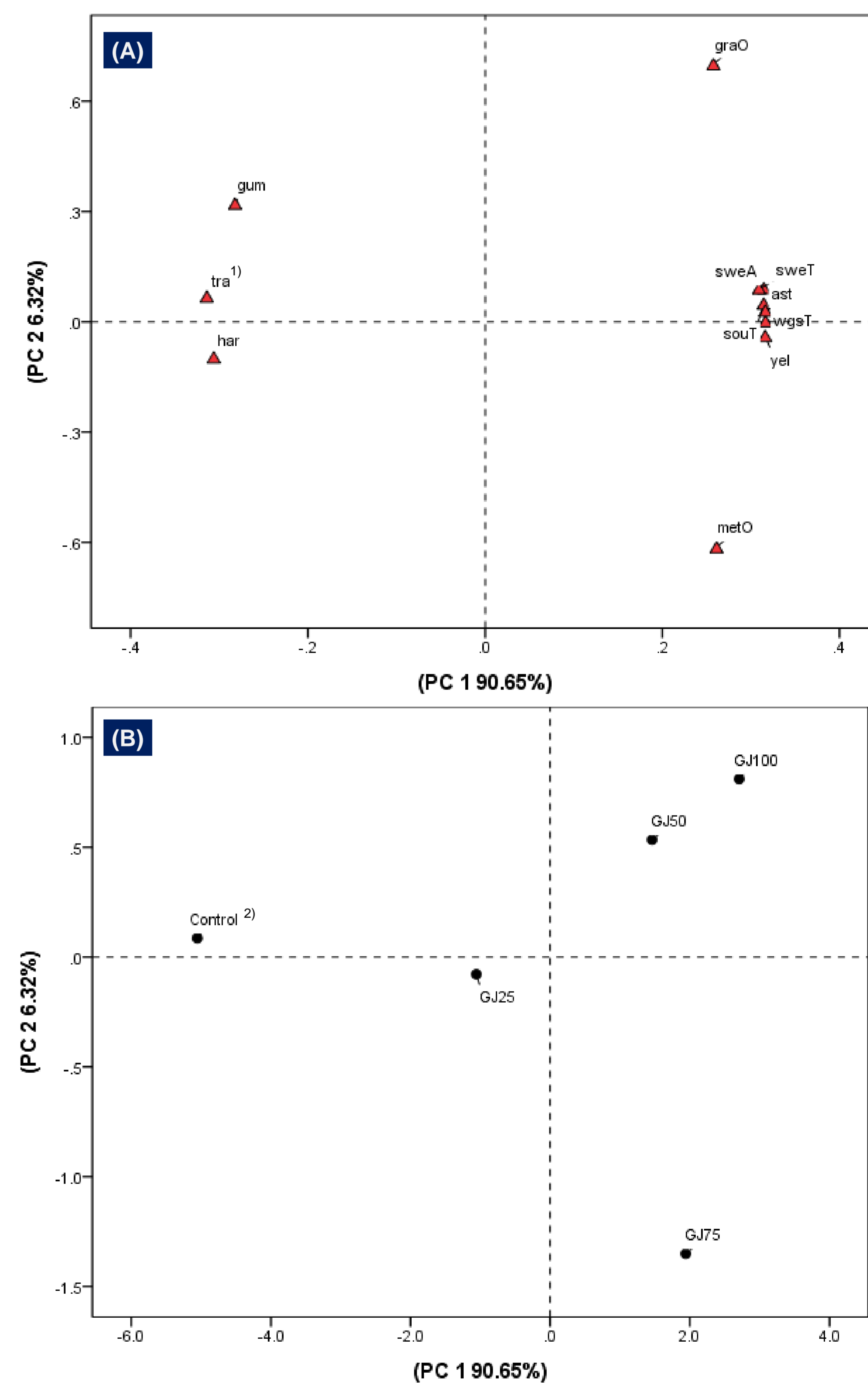


Fig. 2. Principal component analysis (PCA) loadings for sensory attributes (A) and jelly samples (B). <sup>1)</sup> tra: transparency; yel: yellowness; sweA: sweet aroma; metO: metallic odor; graO: grassy odor; sweT: sweet taste; sour: sourness; gsT: green grape skin taste; har: hardness; gum: gumminess; ast: astringency. <sup>2)</sup> Refer to the Table 1.

## Conclusion

The result of principal component analysis showed that the sample groups with high GJ content were classified as having a relatively strong yellow color, sweet aroma, grass smell, sweet taste, sour taste, green grape skin taste, and astringency, and the sample groups with the low GJ content were classified as having a transparency, hardness, and gumminess. In the result of acceptance test, GJ50 sample group was evaluated to be high in flavor ( $p < 0.001$ ) and overall acceptance ( $p < 0.01$ ). Based on the acceptance test results, when producing konjac jelly, 50% of the GJ could be substituted with water. However, sample groups with 50% or more of GJ were evaluated to be significantly strong in astringency. Therefore, further study has to be conducted about improving astringency in the future.