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Preference Mapping of Thai Consumers for Commercial Green Tea with Roasted Brown Rice

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ABSTRACT

The objectives of this study were to investigate: 1) sensory characteristics; 2) consumer acceptability of commercial green tea with roasted brown rice (genmaicha) available in Bangkok, Thailand; and 3) relationships between sensory attributes and consumer acceptance using preference mapping. The seven tea samples used in this study consisted of three brands of dried leaf tea (D) and four brands of infusion tea (I). The sensory descriptive analysis was conducted by eight trained panelists from the Kasetsart University Sensory and Consumer Research Unit (KUSCR). The panel identified 18 sensory attributes. The aroma and flavor intensities of green and seaweed attributes tended to be lower for infusion tea compared to dried leaf tea samples. However, the intensity of dry aroma tended to be higher for infusion tea than for the dried leaf tea samples. The results from principal component analysis (PCA) of descriptive data demonstrated that two principal components (PCs) could explain 87.31% of the variation. The samples were classified into three groups: 1) three brands of dry leaf tea; 2) three brands of infusion tea; and 3) one brand of infusion tea (I-B) with the latter containing stronger roast characteristics than the others. For the acceptability test, tea samples were also evaluated by 200 target consumers. The results of preference mapping identified attributes into 2 PCs, with PC1 being the aroma and flavor of green tea that could describe 66.80% of the variation and PC2 was the taste and aftertaste of tea that explained 17.10% of the variation. The higher tea and dry aromas, but the less intense roast aftertaste were the attributes that may drive consumers' liking of green tea with roasted brown rice.

Keywords: preference mapping, descriptive analysis, green tea, roasted rice, genmaicha

INTRODUCTION

Tea is one of the most popular beverages in the world. It is generally categorized into three groups which consist of green tea (non-fermented tea), oolong tea (semi-fermented tea) and black tea (fermented tea) (Rosen, 1998). Cultivated regions, processing methods and other factors affect the sensory characteristics of tea. Green tea is made from freshly harvested tea leaves by inactivating enzymatic oxidation. It has a fresh, green and astringent taste due to alcohols, aldehydes and polyphenols (Takeo, 1992). Green tea consumption has been increasing because its health-enhancing effects have been reported. It is consumed to improve blood flow and resistance

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to diseases like cancer, cardiovascular disease and diabetes (Hodgson, 2006). A variety of green tea products have been created in tea manufacturing countries. Genmaicha is the Japanese name for green tea combined with roasted brown rice. This tea product was originally drunk by the poor, as the rice served as an ingredient that reduced the price of the tea. Today, genmaicha is consumed by all segments of society. In addition, green tea with roasted brown rice is suitable for young consumers because it has lower caffeine levels than other green teas.

There have been many studies evaluating the sensory properties of tea. Lee and Chambers (2007) developed a descriptive flavor lexicon for green tea. Cho *et al*. (2005) studied the effects of sensory characteristics and non-sensory factors on consumer liking of canned tea products. Liang *et al*. (2007) analyzed the chemical composition that related to taste, flavor and infusion color of jasmine-scent tea. Although information on the sensory characteristics of green tea has been published, there is limited information on the sensory characteristics of green tea combined with roasted brown rice.

The objectives of this study were to investigate: 1) the sensory characteristics and consumer acceptability of commercial green tea with roasted brown rice (genmaicha) available in Bangkok, Thailand; and 2) the relationships between sensory attributes and consumer acceptance, using internal preference mapping.

MATERIALS AND METHODS

Materials

Seven samples of commercial green tea with roasted brown rice product (Table 1) available on the Thai market and imported from Japan and Korea were used in this study. All tea samples were stored at 4°C for less than two months before evaluation.

Descriptive sensory evaluation

Tea samples were tested using descriptive analysis (Lawless and Heymann, 1998).

Panelists

Eight trained panels from the Sensory and Consumer Research Unit, Kasetsart University, Thailand, aged from 33 to 46 years, participated in this study. These panelists had been working on descriptive analysis tasks for several food products over the previous two years.

Training

Samples of green tea blended with roasted brown rice were evaluated in triplicate by a trained panel (N=8). Panelists scored attributes on a 0-to-15 numerical scale with one significant digit. On the first day of training, each panelist received three green tea samples (including three types of green tea: sencha, bancha and matcha) and was asked to generate product attributes.

Table 1 Descriptions and code names for samples of green tea with roasted rice.

Product type	Description	Origin	Producer	Code
Dried leaf	Genmaicha Japanese green tea (Sencha, Matcha)	Japan	A	D-A
	Genmaicha Japanese green tea (Bancha)	Japan	B	D-B_1
	Genmaicha Japanese green tea (Matcha)	Japan	B	D-B_2
Tea bags	Genmaicha Japanese green tea (Sencha blend)	Japan	C	I-C_1
	Genmaicha Japanese green tea (Matcha blend) (green tea 50%, roasted rice 46%)	Japan	C	I-C_2
	Genmaicha Japanese green tea (Sencha blend)	Japan	B	I-B
	Brown rice green tea	Korea	D	I-D

Panelists described the appearance, aroma, flavor and taste attributes of the tea samples. Panelists decided the descriptors for each attribute and produced a definition (Table 2) by consensus. Panelists also identified reference standards for rating product attributes.

In the second session of training, panelists reviewed the terms, definitions and references of the tea samples. Each Panelists rated the intensity of reference standard for each attribute (Table 3) and produced a consensus score for the reference standard. In the third session, the panel reviewed the reference standards. Three of the samples were selected as warm-up samples during training. Panelists scored warm-up samples and adjusted their scales until the standard deviation of scores was less than 1.0. On each day of training, Panelists were calibrated with warm-up samples and they then rated the samples using 0-to-15 numerical scale ballots. There were eight sessions for panel training before product testing.

Sample preparation

Tea samples were removed from the refrigerator at least 1 hr before brewing. Two grams of tea samples (packed in tea filter paper) were brewed with 200 ml of boiling water (80°C) in a white ceramic cup for 3–5 min (following the instructions on the tea packages). Three cups of each sample were poured into a vacuum bottle before serving.

Sample evaluation

The tea liquor was evaluated in triplicate in terms of appearance, aroma, flavor, taste and aftertaste. For each sample, 30 mL of green tea liquor was presented in a white ceramic cup with a cap, coded with three digit random numbers and served at 60°C. a spit cup for expectoration, paper napkins and palate cleansers (unsalted crackers and drinking water) were provided for each panel member. Panelists evaluated one sample at a time with a break of 3 min between samples. Three samples were evaluated in one session, and four samples were presented in another session. Two sessions were conducted each day, with at least a break of 1 hr between sessions.

Consumer testing

Consumer testing was conducted using 200 consumers who were recruited at universities, churches, offices and a public center in Bangkok, Thailand. Target consumers were selected based on their consumption of green tea, if they had consumed at least one cup/month of green tea infusion. Respondents answered questions about attitudes and behaviors of green tea infusion drinking. Each consumer rated tea samples for likeness of color, clear (turbidity), aroma, flavor, bitter taste and overall liking using a 9-point hedonic scale with 9 = "like extremely" and 1 = "dislike extremely." The samples were served to each consumer in sequential monadic order. Two sessions of consumer testing were conducted, with three samples in the first session and four samples in another and a break of 1 hr between the sessions.

Statistical analysis

Multivariate analysis of variance (MANOVA) and analysis of variance (ANOVA) were employed to analyze data. Descriptive and consumer test data were analyzed individually and then together. ANOVA and principal component analysis (PCA) were used to analyze the descriptive data with SPSS® version 12.0. The covariance matrix was used to perform PCA. The preference mapping technique was performed using XLSTAT version 2008 (demo version) to identify drivers for liking of green tea with roasted brown rice.

RESULTS AND DISCUSSION

Descriptive analysis

MANOVA and ANOVA showed that the intensities of all 18 sensory attributes were

Table 2 Descriptors and definitions used by the trained panelists to describe sensory attributes of tea samples.

Descriptors	Abbreviation	Definition
Appearance of tea liquor		
Yellow color	Yel	The intensity of yellow color from colorless to dark yellow
Clear (turbidity)	Cl	The appearance associated with turbidity of the samples
Aroma of tea liquor		
Tea	TeaA	The aromatics associated with tea
Dry	DryA	The dry, slightly dusty aromatics with the absence of green; associated dry grain stems
Green	GrA	Sharp, slightly pungent aromatics associated with green plant/vegetable matter, such as asparagus, sprouts, celery, green beans, parsley, spinach
Seaweed	SeaA	The aromatic associated with shellfish, fresh fish and ocean vegetation
Roast	RoA	The aromatic associated with roasted rice
Flavor of tea liquor		
Tea	TeaF	The aromatic associated with tea
Dry	DryF	The dry, slightly dusty aromatics with the absence of green; associated dry grain stems
Green	GrF	Sharp, slightly pungent aromatics associated with green plant/vegetable matter, such as asparagus, Brussels sprouts, celery, green beans, parsley, spinach
Seaweed	SeaF	The aromatics associated with shellfish, fresh fish and ocean vegetation
Roast	RoF	The aromatics associated with roasted rice
Taste of tea liquor		
Bitter	Bit	A basic taste factor of which caffeine in water is typical
Mouth feel of liquor		
Astringent	Ast	The drying, puckering sensation on the tongue and other mouth surfaces
Aftertaste of liquor		
Tea	TeaAf	The aromatics associated with tea
Roast	RoAf	The aromatics associated with roasted rice
Bitter	BitAf	A basic taste factor of which caffeine in water is typical
Astringent	AstAf	The drying, puckering sensation on the tongue and other mouth surfaces

Table 3 Standard references and intensity ratings used in the descriptive analysis of green tea with roasted brown rice.

Attribute	Reference standards	Intensity
Appearance of tea liquor		
Yellow color	Munsell Book Scales:	
	7.5YR 8/4	3.0
	7.5YR 8/10	9.0
Clear (turbidity)	Distilled water	0
	Wheat flour solution 0.01g/100 ml	7.0
Aroma of tea liquor		
Tea	Dry black tea leaves (Three Horses Tea no.1, Thailand)	7.0
Dry	Dry banana leaves	7.0
Green	Fresh banana leaves	5.0
Seaweed	Bancha Japanese green tea (Daigo shoten, Japan)	5.0
Roast	Roasted brown rice brewed with 200 mLl water at 80°C for 5 min	4.0
Flavor of tea liquor		
Tea	Black tea (1.5 g black tea [Three Horses Tea no.1, Thailand]) brewed with 200 mLl water at 80°C for 3 min	9.0
Dry	Dry banana leaves	7.0
Green	Fresh banana leaves	5.0
Seaweed	Bancha Japanese green tea (2 g green tea [Daigo shoten, Japan] brewed with 200 mLl water at 80°C for 5 min)	4.0
Roast	Roasted brown rice brewed with 200 mLl water at 80°C for 5 min	5.0
Taste of tea liquor		
Bitter	Caffeine solutions:	
	0.02%	3.5
	0.06%	8.5
Mouth feel of tea liquor		
Astringent	Aluminum sulfate solutions:	
	0.10%	4.0
	0.15%	7.0
Aftertaste of tea liquor		
Tea	Black tea (1.5 g black tea [Three Horses Tea no.1, Thailand] brewed with 200 mLl water at 80°C for 3 min)	9.0
Roast	Roasted brown rice brewed with 200 mLl water at 80°C for 5 min	5.0
Bitter	Caffeine solution 0.02%	3.5
Astringent	Aluminum sulfate solution 0.10%	4.0

significantly different (P<0.05) among the seven green tea samples. The mean scores of descriptive sensory attributes are presented in Table 4.

There was a more intense yellow color in the infusion tea samples than in the dried leaf tea samples. The I-C_1 sample (including sencha Japanese green tea) received the highest color score among the infusion tea samples, because sencha green tea use a steaming process over a short time (30 sec) that gave a light green color (yellow-green color) (Hara, 2001). The longer the steaming time, the more easily the tea leaf cell membrane breaks down during later processing.

The aroma and flavor intensities of green and seaweed attributes of infusion tea tended to be lower than those in the dried leaf tea samples. However, infusion tea samples were characterized as having more tea aroma, dry aroma, tea flavor, dry flavor, bitter and astringent than dried leaf tea samples. This may have been due to different green tea processing. All infusion tea samples from tea bags had more intense tea aroma and flavor than dried leaf tea samples.

Correlation of descriptive sensory attributes

Principal component analysis (PCA) was used to analyze the mean ratings of each green tea with roasted brown rice sample across the 18 attributes. The seven commercial green tea with roasted brown rice samples were significantly different (P<0.05) using descriptive sensory attributes. Two principal components (PCs) described 87.31% of the total variability. PC1 was characterized by aroma and the flavor of green tea that explained 62.09% of the variation. Meanwhile, PC2 was identified by the taste and aftertaste of tea that explained 25.22% of the variation. A bi-plot of the samples classified them into threee groups (Figure 1), composed of: 1) three brands of dried leaf tea; 2) three brands of infusion tea; and 3) one brand of infusion tea (I-B). The results from descriptive analysis (Table 4) showed that the I-B sample had stronger roast aroma, flavor and aftertaste than other samples.

Table 5 shows the factor loadings, with an absolute value greater than 0.70 representing a strong influence. The PCA plot and factor loadings

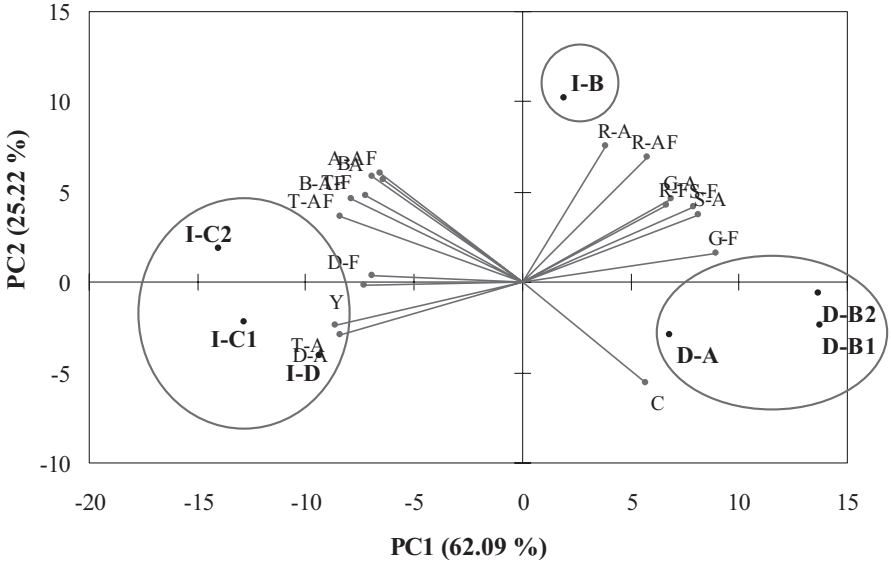

Figure 1 Principal component analysis (PCA) loadings for sensory attributes and commercial green tea with roasted brown rice products.

Table 4 Means[a] of sensory attributes of green tea with roasted brown rice infusion.

Attributes	D-A	D-B_1	D-B_2	I-C_1	I-C_2	I-B	I-D
Yel	4.19±0.11d	3.77±0.31e	3.83±0.34de	7.31±0.23a	5.40±0.37b	4.63±0.11c	4.63±0.27c
Cl	9.77±0.14bc	12.04±0.43a	9.48±0.31bc	8.38±0.17d	7.40±0.47e	7.80±0.13e	10.13±0.22b
TeaA	4.06±0.06bc	3.75±0.17c	3.98±0.13bc	4.63±0.39a	4.63±0.22a	3.98±0.13bc	4.52±0.32ab
DryA	2.69±0.27c	2.52±0.04c	2.71±0.10bc	3.29±0.22a	3.14±0.13ab	2.59±0.29c	3.17±0.18a
GrA	2.46±0.20a	2.27±0.18ab	2.56±0.06a	1.94±0.13bc	2.17±0.13bc	2.48±0.30a	1.81±0.23c
SeaA	2.15±0.13bcd	2.50±0.19ab	2.73±0.13a	1.81±0.06cd	1.73±0.18cd	2.50±0.31ab	1.65±0.20cd
RoA	3.10±0.13de	3.88±0.13b	3.48±0.10bcd	3.21±0.20cde	3.15±0.25cde	4.74±0.42a	2.92±0.25e
TeaF	4.48±0.13c	4.69±0.38c	4.31±0.54c	5.40±0.28ab	5.94±0.22a	5.59±0.35ab	5.00±0.23bc
DryF	2.90±0.14ab	3.00±0.11ab	2.65±0.24b	3.29±0.24a	3.25±0.25a	2.98±0.16ab	2.92±0.25ab
GrF	2.23±0.14a	2.46±0.13a	2.52±0.04a	1.65±0.07b	1.73±0.07b	2.18±0.16a	1.60±0.16b
SeaF	1.75±0.11a	1.79±0.13a	1.79±0.24a	1.17±0.10b	1.19±0.11b	1.89±0.16a	1.06±0.17b
RoF	2.17±0.18b	3.46±0.25a	3.31±0.39a	2.31±0.13b	2.31±0.23b	3.33±0.13a	2.13±0.11b
Bit	2.04±0.07bcd	1.81±0.11d	1.98±0.34cd	2.69±0.17abc	3.35±0.07a	3.28±0.04a	2.79±0.22ab
Astr	2.02±0.14bcd	1.58±0.20d	1.88±0.17cd	2.23±0.13abc	2.65±0.20a	2.78±0.06a	2.50±0.23ab
TeaAf	1.69±0.32bcd	1.48±0.57d	1.50±0.23cd	2.21±0.22ab	2.50±0.06a	2.24±0.22ab	2.13±0.06abc
RoAf	0.65±0.20ab	0.63±0.13ab	0.71±0.04ab	0.48±0.07b	0.56±0.06ab	0.83±0.14a	0.46±0.07b
BitAf	0.56±0.11bc	0.44±0.11c	0.40±0.10c	1.21±0.04a	1.44±0.06a	1.32±0.13a	1.08±0.13ab
AstrAf	1.17±0.13ab	1.13±0.28b	1.25±0.23ab	1.54±0.10ab	1.65±0.07ab	1.78±0.16a	1.54±0.10ab

[a] = Means in rows followed by different letters represent significant differences ($P<0.05$).

indicate that PC1 was influenced by the aroma and flavor of green tea, while PC2 was related to the bitter and astringent taste of the tea. The correlation of sensory attributes showed that some attributes were highly correlated: tea and dry aromas (factor loading = 0.84-0.86); green and seaweed aromas (factor loading = 0.78-0.87); green and seaweed flavors (factor loading = 0.76-0.94); and bitter and astringent (factor loading = 0.82-0.94).

Tea and dry aromas were the specific characteristics of tea products that the panel could detect. Meanwhile, green aroma, seaweed aroma, green flavor and seaweed flavor were particular characteristics of green tea which included alcohols, aldehydes and polyphenols (Takeo, 1992). In addition, bitter and astringent attributes were important for tea products which contained catechin and tannin compounds (Wang *et al.*, 2000). In the current study, green tea with roasted brown rice had different attributes from other green tea products, including roast aroma, flavor and aftertaste. From factor loadings, the roast aftertaste was highly correlated in PC1.

Consumer testing

Target consumers who tested tea samples were composed of 32.5% males and 67.5% females. Analysis by ANOVA indicated that liking scores for color, clear (turbidity), aroma, flavor, bitter taste and overall liking of green tea with roasted brown rice samples were significantly different ($P<0.05$). There were differences between samples in the color and clear attributes of all samples ($P<0.05$). The D-B_1 and I-D samples were the most liked in terms of the color and clear attributes. The I-C_1, I-C_2 and I-D samples were the most liked in terms of aroma and flavor. The I-C_1 and I-C_2 samples were the most liked in terms of a bitter taste. I-C_1 and I-D were the most liked samples for overall liking. Therefore, the important sensory attributes that drive consumers' liking might be aroma, flavor and bitter taste.

Table 5 Factor loadingsfor the sensory attributes of green tea with roasted brown rice. (Loadings with an absolute value greater than 0.70 are shown in bold type).

Sensory attributes	PC1	PC2
Yel	0.67	0.13
Cl	0.11	0.67
TeaA	**0.84**	0.10
DryA	**0.86**	0.06
GrA	**0.78**	0.00
SeaA	**0.87**	0.05
RoA	0.56	0.24
TeaF	0.19	**0.73**
DryF	0.63	0.17
GrF	**0.76**	0.24
SeaF	**0.94**	0.02
RoF	0.64	0.00
Bit	0.05	**0.93**
Astr	0.02	**0.94**
TeaAf	0.26	**0.73**
RoAf	**0.87**	0.10
BitAf	0.17	**0.83**
AstrAf	0.03	**0.94**

Table 6 Mean hedonic scores[a] of commercial green tea with roasted brown rice.

Attributes	D-A	D-B_1	D-B_2	I-C_1	I-C_2	I-B	I-D
Color	6.09±1.73cd	6.62±1.45a	6.28±1.68bc	5.96±1.81cd	6.07±1.68cd	5.90±1.27d	6.47±1.62ab
Clear	5.91±1.92b	6.80±1.54a	6.14±1.71b	5.90±1.81b	5.84±1.75b	5.91±1.33b	6.63±1.56a
Aroma	5.44±1.99c	5.46±1.77c	5.71±1.74abc	5.80±1.75abc	5.90±1.80ab	5.52±1.99bc	6.04±1.66a
Flavor	5.38±2.05c	5.53±1.78bc	5.81±1.70ab	5.98±1.72a	5.92±1.78a	5.40±2.05c	5.93±1.72a
Bitter Taste	4.92±2.05d	5.46±1.91bc	5.76±1.73ab	6.00±1.72a	5.95±1.83a	5.37±1.78c	5.80±1.81ab
Overall Liking	5.74±1.86b	5.79±1.74ab	5.94±1.67ab	6.15±1.68a	6.02±1.72ab	5.35±1.70c	6.15±1.67a

[a] = Means in rows followed by different letters represent significant differences ($P<0.05$).

Preference mapping

Preference mapping was used to model the consumer liking patterns for green tea with roasted brown rice (Figure 2). Two principal components (PCs) described 83.90% of the variation. PC1 was characterized by tea aroma, dry aroma, green aroma, seaweed aroma, green flavor, seaweed flavor and roast aftertaste that explained 66.80% of the variation. Meanwhile, PC2 was identified by a tea flavor, bitter, astringent, tea aftertaste, bitter aftertaste and astringent aftertaste that could describe 17.10% of the variation.

Correlations among descriptive sensory attributes and consumers' liking are shown in Table 7. Many of these correlations were expected. For example, the aroma and flavor of tea, dry, green and seaweed were positively correlated. Moreover, bitter was also highly correlated with astringent (factor loading = 0.97); tea aftertaste (factor loading = 0.95); bitter aftertaste (factor loading = 0.97) and astringent aftertaste (factor loading = 0.97). Consumers' liking was positively correlated with tea and dry aromas, but it was negative correlated with green and roast aromas. Furthermore, consumers' liking was highly negative with the seaweed flavor (factor loading = - 0.82) and roast aftertaste (factor loading = - 0.89). These results suggest that high roast aroma and aftertaste do not essentially stimulate consumers' acceptance. Tea and dry aromas may drive consumers' liking.

From the preference mapping plot (Figure 2), sample I-D had a positive loading with consumers' liking. Descriptive sensory attributes could be identified high intensities of tea and dry aromas, but low intensities of roast aroma and aftertaste of sample I-D. The results showed that these attributes might be the drivers of the liking by consumers of the product.

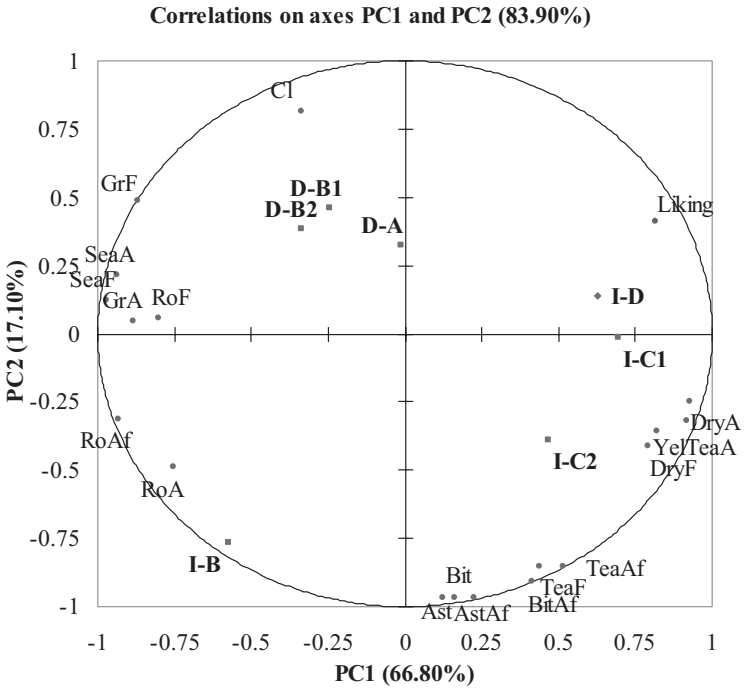

Figure 2 Preference mapping of descriptive sensory attributes and consumer preferences for commercial green tea with roasted brown rice.

CONCLUSION

Consumers' preferences are influenced by many intrinsic and extrinsic factors. Internal preference mapping is a useful tool to investigate the relationship between consumers' preferences and descriptive sensory attributes. From this study, the descriptive panel developed a definition for 18 sensory attributes to evaluate roasted brown rice green tea samples. Results from preference mapping showed that the consumers had a product preference for green tea with roasted brown rice depending on the tea and dry aroma. Moreover, the roasted aroma and aftertaste were negatively correlated with consumers' liking. It was found that the most liked sample (I-D) contained high tea and dry aromas, but low intensities of roasted aroma and aftertaste. Therefore, research should concentrate on processing to preserve the aroma and flavor of the green tea blended with roasted brown rice, in order to develop a product that meets with consumer satisfaction.

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Table 7 Correlations among descriptive sensory attributes and consumers' liking[a].

Variables	Yel	Cl	TeaA	DryA	GrA	SeaA	RoA	TeaF	DryF	GrF	SeaF	RoF	Bit	Astr	TeaAf	RoAf	BitAf	AstrAf	Liking
Yel	1.00	-0.56	**0.85**	**0.90**	**-0.84**	**-0.75**	-0.31	**0.62**	**0.81**	**-0.91**	**-0.82**	-0.59	0.49	0.41	**0.69**	**-0.66**	**0.67**	0.54	0.53
Cl		1.00	**-0.68**	-0.61	0.16	0.46	0.01	**-0.75**	-0.39	**0.68**	0.44	0.42	**-0.89**	**-0.92**	**-0.88**	-0.02	**-0.86**	**-0.88**	-0.03
TeaA			1.00	**0.98**	**-0.74**	**-0.90**	-0.61	**0.64**	**0.75**	**-0.94**	**-0.95**	**-0.78**	0.53	0.46	**0.75**	**-0.72**	**0.66**	0.48	**0.69**
DryA				1.00	**-0.80**	**-0.85**	-0.59	0.59	**0.75**	**-0.92**	**-0.96**	**-0.70**	0.46	0.37	**0.69**	**-0.77**	**0.61**	0.44	**0.75**
GrA					1.00	**0.80**	0.44	-0.51	**-0.90**	**0.80**	**0.87**	0.51	-0.22	-0.05	-0.48	**0.89**	-0.44	-0.20	**-0.69**
SeaA						1.00	**0.65**	**-0.60**	**-0.86**	**0.92**	**0.91**	**0.88**	-0.42	-0.34	**-0.68**	**0.80**	-0.58	-0.30	-0.59
RoA							1.00	0.15	-0.24	0.40	**0.67**	**0.76**	0.27	0.29	0.01	**0.79**	0.16	0.38	**-0.83**
TeaF								1.00	**0.79**	**-0.78**	-0.56	-0.29	**0.94**	**0.84**	**0.96**	-0.18	**0.97**	**0.89**	0.02
DryF									1.00	**-0.90**	**-0.81**	-0.55	0.56	0.41	**0.75**	**-0.68**	**0.73**	0.49	0.39
GrF										1.00	**0.89**	**0.74**	**-0.66**	-0.57	**-0.86**	**0.66**	**-0.80**	**-0.61**	-0.48
SeaF											1.00	**0.71**	-0.36	-0.23	**-0.61**	**0.88**	-0.52	-0.30	**-0.82**
RoF												1.00	-0.23	-0.26	-0.47	**0.65**	-0.35	-0.11	-0.49
Bit													1.00	**0.97**	**0.95**	0.10	**0.97**	**0.97**	-0.18
Astr														1.00	**0.90**	0.23	**0.92**	**0.95**	-0.30
TeaAf															1.00	-0.21	**0.99**	**0.90**	0.08
RoAf																1.00	-0.11	0.16	**-0.89**
BitAf																	1.00	**0.95**	-0.04
AstrAf																		1.00	-0.21
Liking																			1.00

[a] = Numbers in bold represent significant correlations ($P<0.05$).

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