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Changes in Consumer Color Preference for 'Songpyun', a Korean Rice Cake

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ABSTRACT Color is one of the most important attributes determining the purchase of food products by consumers. Therefore, the purpose of this study was to identify consumer color preferences for songpyun, a traditional Korean rice cake, by a consumer acceptance test and using coated Pantone color chips. Color evaluation tools for the study were developed accordingly. From the results, the songpyun sample designated as product E was given the highest color acceptability score, and was 'slightly liked' ($p<0.05$). The color of product E was 'very pale red-purple'. All the evaluated pink-color songpyun products were based on this red-purple hue, however, they had differences in tone. The consumer panel favored a pale tone over a bright tone. The color concept for traditional songpyun within the pink color category was identified as 'very pale red-purple', using coated Pantone color chips. This result for the conceptual color preference was consistent with that of the consumer color acceptance test. Thus, color chips could be an effective tool when applied for color standardization in traditional foods production. From the overall results, it seems consumers are perceiving color trends and are willing to adapt to such changes in food applications.

KEYWORDS: color preference, consumer acceptance, pink 'Songpyun', color chip

INTRODUCTION

Color is one of the most important attributes determining the purchase of food products by consumers (Marshall et al 2006; Kohata et al 2006; Clydesdale 1993). In wine, color can alter perceptions of taste, smell, and flavor (Delwiche 2003), as well as in other foods such as cake (DuBose et al 1980) and yogurt (Teerling 1992). The addition of food coloring impacted the sweetness ratings of white wine (Pangborn et al 1963). And in sugar solution, taste and flavor intensity tended to increase as the color level increased (Johnson and Clydesdale 1982).

Changes in consumer preferences for color occur slowly with the color trends in sectors such as fashion, interior design, and non-food products (Syn et al 2004). Recently, colors introduced for non-food items have been applied to traditional Korean foods. Bright colors have been used for traditional Korean rice cakes (Kim 2002; Kim et al 1996). However, color changes related to brightness, and saturation, rather than the hue itself, are being noticed in the market (Kim 1998; Lim 2003).

Songpyun is a favorite traditional Korean rice cake. Natural colorants have been added to rice cakes for health and wellness purposes, which have resulted in product color changes. Synthetic colorants are also being applied for more vivid and never-before-seen colors, which seem to be well accepted by consumers. However, very few studies have examined the effects of color changes with respect to traditional foods.

In designing a product, color chips are used to identify and control colors for quality management. They are also used to determine consumers' visual images of a product according to its color (Schifferstein 2005).

The purpose of this study was to investigate consumers' color preferences for songpyun, a Korean rice cake, by sensory evaluation, in which tools were developed to detect for changes in color preference. Color chips were also presented to determine what songpyun color was most desirable as well as considered most traditional by Korean consumers, as insight for future food applications.

MATERIALS AND METHODS

Samples

Five 'Songpyun' samples within the pink color category were purchased from five rice cake stores.

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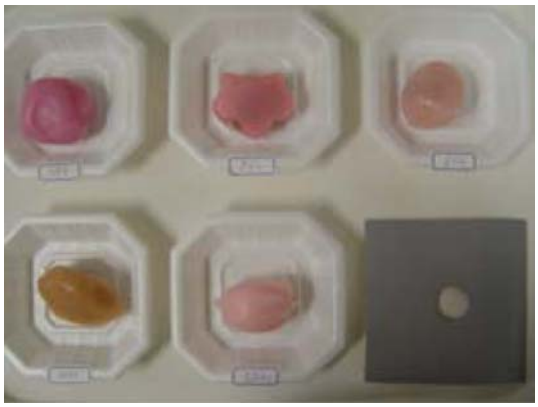

Fig. 1. 'Songpyun' samples for color acceptance test. Clockwise from the top: Product C, Product B, Product D, Gray cover, Product E, Product A.

Fig. 2. Color chip panel developed for color preference test and consumer acceptance test.

The five samples were presented and tested using the same procedures.

Presentation

All samples were served separately on a small white rectangular dish. Gray cards (L=33.64, a=0.35, b=−1.20) with 1-inch diameter holes were used to cover the samples to prevent distraction from the shapes of samples as well as to put focus on the color evaluation. Eight color chips, arranged on a gray panel (5 cm×3 cm), were also presented so that the panelists could select the most favorable songpyun color.

Consumer acceptance test

Two-hundred and thirty-four consumers, between the ages of 16 to 69 years, were recruited from Seoul and Suwon, Korea. The tests were conducted at six locations (Shinchon Yonsei University and Ewha University campuses, Seocho-ku community Center, Youngdong Church, Mokdong residence area, University of Suwon campus, and Suwon residence area). The consumer acceptance test for pink-colored songpyun was performed using a 9-point hedonic scale (1=dislike extremely, 5=neither like nor dislike, 9= like extremely). The panelists also rated the songpyun samples for color appropriateness using a 5-point JAR (just-about-right) scale (1=much too pale, 3=just about right, 5=much too dark). The consumers were asked to select the most favorable and the most traditional colors among the samples.

Identification of desired color concept

In order for the consumers to select the most desirable pink color for songpyun, eight color chips (Pantone coated) were presented to provide a broad spectrum of colors for selection. The panel was then asked to select the most preferred among the eight color chips.

The colors of the songpyun samples and Pantone chips were named according to the IRI color system (Hue & Tone 120) to interpret the data.

Color measurement

The color of the songpyun was determined by Hunter's color values [L (lightness), a (redness), b (yellowness)] using a Colorimeter (JS555, Sun Scientific Co., Japan).

Experimental Design & Statistical Analysis

The consumer acceptance tests were performed according to a randomized complete block design. T-tests and analysis of variance (ANOVA) of the sample means and Tukey's multiple comparison test were conducted at the 95% confidence interval ($p<0.05$) using the SPSS Program (Ver. 13).

RESULTS AND DISCUSSION

Demographic background of consumers

The 234 consumer panelists were recruited from six regions to test the acceptability of songpyun color. Table 1 shows the demographic background data of the participants. The 93 male (39.7%) and 141 female (60.3%) participants were between the ages of 16 to 69 years. The age

Table 1. Demographic background of consumers

Characteristics		Number (%)
Gender	Female	141(60.3)
	male	93(39.7)
Age(yrs)	10-29	92(39.7)
	30-49	80(34.5)
	50-69	60(25.8)
Job	Students	99(42.3)
	Office worker	81(34.6)
	Housewife	54(23.1)
Monthly Income (10,000won)	100<income≤200	136(58.1)
	200<income<500	71(30.4)
	500<income	27(11.5)
Residence area	Kangnam	88(37.6)
	Kangbook	67(28.6)
	Seoul Vicinity	79(33.8)
Overseas travel experience	None	37(15.8)
	1-5 times	50(21.4)
	Over 6 times	147(62.8)

distributions were as follows: 10 to 29 years (39.7%), 30-49 years (34.5%), and 50-69 years (25.8%). The job descriptions of the participants were: student (42.3%), office worker (34.6%), and housewife (23.1%). The monthly incomes of the participants ranged from 1 million to over 5 million won, in which 58.1% of the participants earned 1-2 million won, 30.4% earned more than 2 million to 5 million won, and 11.5% earned over 5 million won. Residence area information and overseas travel experience were included since it was expected that the environment as well as experiences of the panelists might affect their color acceptance scores. In terms of residence area, 37.6% of the participants were Kangnam residents, 28.6% were Kangbook residents, and 33.8% were from Seoul and its vicinity. Their overseas travel experience was: none (15.8%), 1-5 times (21.4%), and over 6 times (62.8%).

Consumer acceptance test

The consumer color acceptance test was conducted using five samples. The samples were covered with gray (L= 33.64, a=0.35, b=−1.20) cards containing a hole so the panelists would not be distracted by the shapes of the samples. The results are shown in Fig. 3 & Table 2. The colors of samples were named according to the IRI color system (Hue & Tone 120). Product E was given the highest color acceptability score and was 'slightly liked'; it was also found to be significantly different from the other samples ($p<0.05$). The color of product E was 'very pale red-purple'. The color of product D was 'neither liked nor disliked,' and it was significantly different from product E; yet, product D's color was also 'very pale red-purple'. According to the IRI color system, there was no color difference between products D and E, however, a difference was detected by colorimetry (Table 7) in which product D had more lightness and yellowness than product E. Products B and C were rated as 'slightly disliked' and there was no significant difference between them, however, they were significantly different from the other samples. The color of product C was 'bright purple to red-purple' and product B was 'bright red to red-purple'. Product A was deemed the least acceptable among the samples and was 'moderately disliked' by the consumers. The color of product A was 'bright to pale yellow-red'. This hue was caused by discoloration during the heating process when natural colorants were added. The consumers preferred the 'very pale red-purple' songpyun, and disliked the 'bright purple to red-purple' and 'bright red to red-purple' samples. The pink-colored songpyun samples were all based on a red-purple hue, but had differences in tone, and the consumers preferred a pale tone over a bright tone.

The just-about-right (JAR) scale was also used to identify what pink color the consumers would deem 'right' for songpyun (Fig. 4.). Based on the results, the consumers chose the colors of products A and B, which were significantly different from the other samples ($p<0.05$) (Table 2). The pink color of product C was significantly too

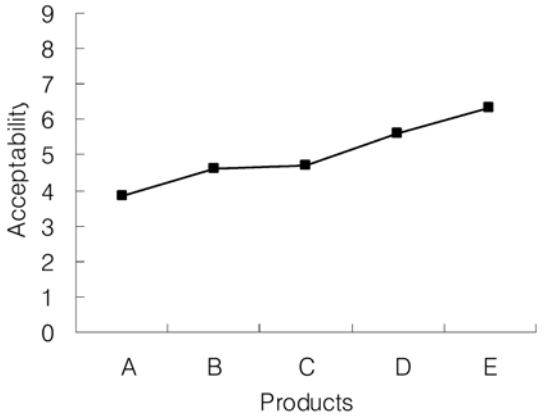

Fig. 3. Consumer color acceptance of various songpyun products.

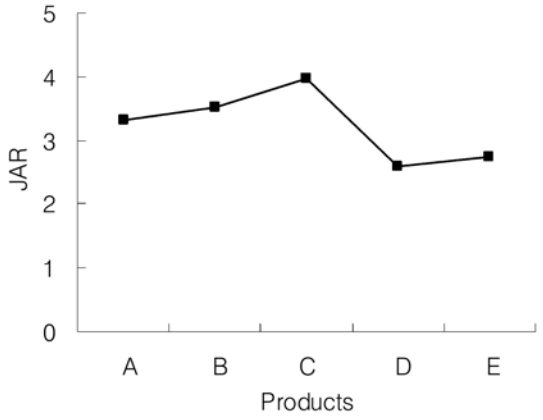

Fig. 4. Just-about-right (JAR) scores for various songpyun products.

Table 2. Color acceptance[1)] and JAR[2)] for various pink songpyun products

Characteristics \ Product	Product A	Product B	Product C	Product D	Product E
Color acceptability[1)]	3.85[a]	4.62[b]	4.70[b]	5.60[c]	6.32[d]
JAR[2)] (Just-about-right)	3.31[a]	3.51[a]	3.98[b]	2.59[c]	2.74[c]

[1)]9-point hedonic scale (9=extremely like, 5=neither like nor dislike, 1=extremely dislike)
[2)]5-point JAR (just-about-right) scale (5=much too dark, 3=just about right, 1=much too pale)
[a,b,c]: Means within a row with different letters are significantly different from one another ($p<0.05$).

Table 3. Songpyun products chosen as the most traditional and most desirable colors N(%)

Characteristics \ Product	Product A	Product B	Product C	Product D	Product E	Total
Traditional Color	14(6.1)	15(6.4)	21(9.1)	69(29.9)	112(48.5)	231(100)
Desired Color	17(7.3)	29(12.4)	31(13.2)	49(20.9)	102(43.6)	234(100)

dark, and it was significantly different from the other samples ($p<0.05$). Products D and E were considered significantly too pale compared to the other samples, but there was no difference between them ($p<0.05$).

Interestingly, there was a discrepancy between the panelists' preferred color and the color they thought was proper for traditional songpyun. 'Bright red to red-purple' and 'bright to pale yellow-red' were chosen as the right colors by the JAR scale. A bright or bright to pale tone was regarded as the 'right' pink for songpyun rather than a pale tone, even though this product had a yellow-red hue. On the other hand, the 'purple to red-purple' product, with the same bright tone, was regarded as too dark.

The consumers were asked to choose the product they considered to have the most traditional songpyun color, as well as most desirable pink color, among the five samples (Table 3). Product E was chosen by 48.5% of the consumers as the most traditional color, whereas 29.9% chose product D. Product E was also chosen as the most desirable pink color for songpyun, followed by product D. These results were contrary to the just-about-right results because the panelists rated products E and D as too pale, and did not give them a 'right' score. On the other hand, these results are similar to those of the consumer acceptance test. This suggests that the consumer acceptance test was more effective for evaluating the color of songpyun. At the same time, one can conclude that there has been a change in the consumer color preference for traditional rice cakes, where they seem to prefer a pale color over a bright color.

Identification of desired color concept

Eight color chips (Pantone coated) were presented to provide a broad spectrum of colors for selection. The consumers were asked to choose the most desirable pink songpyun color among the eight Pantone chips, which were coded as follows: 1905C, 182C, 1895C, 217C, 2365C, 670C, 7422C, and 705C. The color chips were named according to the IRI color system (Hue & Tone 120).

Chip 670C was chosen as the most favorable traditional color by 30.7% of the consumers, followed by 1905C (15.5%), 705C(15.1%), and 7422C(9.3%), respectively. 670C was named as 'very pale red-purple', 1905C as 'bright red-purple to red, 705C as 'very pale red', and 7422C as 'very pale to pale-red'. Therefore, within the pink color category, the color concept for traditional songpyun was identified as 'very pale red-purple'. 'Very pale red-purple' has long been considered an unsuitable food color for traditional songpyun, yet this result was consistent with the consumer color acceptance test. This suggests that consumers have had changes, not only in their color preferences for traditional songpyun, but also in terms of their traditional food color concepts. It may be that consumers are perceiving non-food color trends and are therefore willing to accept those changes and adapt them to food colors.

Consumer color acceptance as affected by demographic factors

The age, job, and residence areas of the panelists did not affect their color acceptability scores. Whereas gender had an effect on product A only, and not the other four products. Product A was 'bright to pale yellow-red' and received the lowest hedonic mean scores; however, males rated it significantly higher than females ($p<0.05$). Only product C was affected by monthly income level and overseas travel experience. The color of product C was 'bright purple to red-purple'. Finally, females were more sensitive to differences in food color. The group of monthly income over 2 million Won disliked product C more than those of monthly income less than 2 million Won ($p<0.05$). The more they had overseas travel experience, they significantly disliked product C less ($p<0.05$).

The JAR mean scores of all five songpyun products were not affected by age, job, income, or overseas travel experience. For product C only, there were significant differences between genders and among residence areas ($p<0.05$). Product C was 'bright purple to red-purple' and was chosen as the most 'right' color for songpyon by the JAR scale. Residents of Kangnam considered product C too dark, while other panelists from Kangbook and the Seoul vicinity considered it 'right' for songpyun. Females also rated it as too dark, whereas males rated it as 'right' ($p<0.05$). Therefore, Kangnam residents and females regard 'bright purple to red-purple' as too dark for songpyon. However, for product E, which had a pale color, there were

Table 4. Identification of desired songpyun color concept by Pantone color chips N(%)

Pantone color chip	1905C	182C	1895C	217C	2365C	670C	7422C	705C
1st choice	35(15.5)	12(5.3)	20(8.9)	14(6.2)	20(8.9)	69(30.7)	21(9.3)	34(15.1)

Table 5. Hedonic mean scores of various songpyun products

Characteristics		Number	Product A	Product B	Product C	Product D	Product E
Gender	Female	141	3.56[a1)]	4.58	4.47	5.72	6.26
	male	93	4.30[b]	4.67[ns]	5.04[ns]	5.43[ns]	6.41[ns]
Age	10-29	92	3.58	4.71	4.90	5.35	6.23
	30-49	80	4.01	4.68	4.61	5.66	6.25
	Over 50	60	4.10[ns2)]	4.40[ns]	4.49[ns]	5.88[ns]	6.57[ns]
Job	Students	99	3.48	4.71	4.89	5.36	6.30
	Office worker	81	4.49	4.86	4.70	5.70	6.26
	Housewife	54	3.57[ns]	4.07[ns]	4.35[ns]	5.89[ns]	6.43[ns]
Income (million Won)	1-2	136	3.75	4.82	5.15[a]	5.49	6.40
	2.01-5	71	4.20	4.39	4.00[b]	5.73	6.21
	Over 5	27	3.48[ns]	4.19[ns]	4.22[a b]	5.81[ns]	6.19[ns]
Residence area	Kangnam	88	3.73	4.55	4.42	5.64	6.26
	Kangbook	67	4.02	4.75	4.76	5.46	6.86
	Seoul Vicinity	79	3.86[ns]	4.58[ns]	4.96[ns]	5.68[ns]	6.22[ns]
Overseas travel experience	None	37	3.63	4.30	3.87[a]	5.86	6.11
	1-5 times	50	3.59	4.56	4.55[a b]	5.68	6.58
	Over 6 times	147	4.00[ns]	4.71[ns]	4.96[b]	5.50[ns]	6.28[ns]

[1)a,b,c]: Means within a column with different letters are significantly different from one another ($p<0.05$).
[2)ns]: not significant.

Table 6. JAR mean scores of five songpyun products by various factors

Characteristics		Number (%)	Product A	Product B	Product C	Product D	Product E
Gender	Female	141	3.30	3.64	4.14[a]	2.61	2.74
	male	93	3.32[ns]	3.32[ns]	3.74[b]	2.56[ns]	2.72[ns]
Age	10-29	92	3.07	3.41	3.83	2.49	2.67
	30-49	80	3.51	3.60	4.11	2.63	2.70
	Over 50	60	3.42[ns]	3.55[ns]	4.05[ns]	2.68[ns]	2.87[ns]
Job	Students	99	3.09	3.46	3.85	2.52	2.69
	Office worker	81	3.41	3.27	3.91	2.60	2.70
	Housewife	54	3.57[ns]	3.96[ns]	4.33[ns]	2.72[ns]	2.87[ns]
Income (million Won)	1-2	136	3.15	3.51	3.85	2.52	2.70
	2.01-5	71	3.59	3.49	4.14	2.66	2.83
	Over 5	27	3.41[ns]	3.59[ns]	4.26[ns]	2.78[ns]	2.67[ns]
Residence area	Kangnam	88	3.36	3.60	4.19[b]	2.61	2.75
	Kangbook	67	3.08	3.36	3.82[a]	2.58	2.75
	Seoul Vicinity	79	3.46[ns]	3.54[ns]	3.89[a b]	2.58[ns]	2.75[ns]
Overseas travel experience	None	37	3.46	3.54	4.26	2.62	2.78
	1-5 times	50	3.04	3.70	3.98	2.68	2.80
	Over 6 times	147	3.36[ns]	3.44[ns]	3.91[ns]	2.55[ns]	2.70[ns]

[1)a,b,c], Means within a column with different letters are significantly different from one another ($p<0.05$).
[2)ns]: notsignificant

no significant differences by demographic factors, and it was considered the most favorable color.

Color measurement

Product D had the highest L (lightness) value, but it was

Table 7. Hunter's color values for various songpyun products

Value	Product A	Product B	Product C	Product D	Product E
L	26.9[a]*	27.2[a]	28.8[ab]	35.3[c]	31.3[bc]
a	2.5[a]	5.9[b]	7.6[c]	3.4[a]	3.5[a]
b	4.2[a]	0.7[b]	-3.0[c]	1.3[b]	0.6[b]

[1)a,b,c]: Means within a row with different letters are significantly different from one another ($p<0.05$).
[2)]3 replications

not significantly different from product E ($p<0.05$). Product A had the lowest L-value, but it was not significantly different from products B and C ($p<0.05$). The L-values of products C and E were also not significantly different from each other. The a-values (redness) of products A, D, and E were not significantly different ($p<0.05$). Product C had significantly higher redness as compared to the other samples, followed by product B ($p<0.05$). The b-value (yellowness) of product A was significantly higher than the b-values of the other samples. Product B, product D, and product E had slight yellowness, but they were not significantly different from each other ($p<0.05$). Product C had a negative value; thus, it was significantly different from the other samples, showing blueness ($p<0.05$).

CONCLUSION

Because color is one of the most important attributes determining the purchase of food products by consumers, there is a need for research on how consumer color preferences for traditional rice cakes have changed. Songpyun, which is a favorite traditional Korean rice cake, was chosen for this study. A consumer acceptance test and color chips were used to identify the most favorable and most traditional songpyun colors, as well as the desired color concept for songpyun, within the pink spectrum.

Product E, whose color was 'very pale red-purple', was given the highest color acceptability scores and was 'slightly liked' ($p<0.05$). The pink-colored songpyun products were all based on a red-purple hue; however, they had differences in tone. Consumers preferred a pale tone over a bright tone. The colors of products A and B were regarded as 'just about right' by the JAR scale. Product A was 'bright to pale yellow-red' and product B was 'red to red-purple'. Product C was significantly darker and different than the other samples ($p<0.05$). And products D and E were significantly more pale than the other samples; however, there was no difference between them ($p<0.05$). A discrepancy was noted between what the consumers preferred and what they deemed as the proper color for songpyun.

When the consumers were asked to chose the most desirable as well as most traditional color for songpyun, product E was selected, followed by product D. These results were similar to those of the consumer acceptance test and contrary to those of the just-about right test. This suggests that the consumer acceptance test was more effective than the JAR scale to identify consumer color preferences for songpyun. And at the same time, one can conclude that consumers' color preferences for traditional rice cakes are changing, where they prefer a pale color over a bright color.

There were significant differences in product color preferences between the genders for product A and among income and overseas travel experience for product C ($p<0.05$). Respondents with higher monthly income over 2 million Won disliked product C significantly more than those with less income ($p<0.05$). The more they had overseas travel experience, the less they disliked product C ($p<0.05$).

There were significant differences in JAR between the genders and among residence areas ($p<0.05$). Kangnam residents and females regard product C, having a 'bright purple to red-purple' color, as too dark for songpyon ($p<0.05$). The selection of product C was affected by monthly income level and overseas travel experience. Females were more sensitive to differences in food color for product A and males gave significantly higher scores than the females ($p<0.05$).

Within the pink category, the color concept for traditional songpyun was identified as 'very pale red-purple', using coated Pantone color chips. This result was consistent with that of the consumer color acceptance test. Thus, color chips could be an effective tool when applied for color standardization in traditional foods production. Color measurements by colorimeter could provide more information for interpretation of the data. But overall, it is clear that consumers are perceiving non-food color trends, and seem willing to accept those changes for food applications.

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