Impression of Label Color in PET Bottled Black Tea

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Abstract: To examine the impression including the visual deliciousness with label color in PET bottled black tea, the impressions of the combination between label color and color of black tea were measured using subjective evaluation and SD method with varying the way of its combination. For the stimulus, they were three types of black tea and eleven types of label color rapped in the PET bottles. In the results, the common black tea and yellowish black tea are evaluated visually delicious in reddish and yellowish colored label of PET bottles, whereas the value of visual deliciousness in the reddish black tea is lower than the others. Overall the results are a similar tendency to those of previous studies. In conclusion, it was shown that both the color of the tea beverage and the color of the packaging label have an effect on the evaluation of the taste and impression.

Keywords: Impression, Label color, Black tea, Subjective evaluation, Deliciousness

1. INTRODUCTION

As you know that colors affect the impression of taste to humans. It is also able to imagine that they are used for packaging labels of beverages in applicable point of view. It is reported that the effects of changing the color of the packaging label on the taste and impression of a popular PET-bottled tea beverage in present[1]. And it was reported that the colors of food and beverage have a significant effect on the preference and the perceived tastes[2]. In addition, it was reported that sweetness is a strong promoter of overall pleasantness of soft drinks[3]. However, there are very few studies on the color of beverages and labels. With the current popularity of PET beverage bottles, it is important to conduct a comprehensive study in different laboratories. The purpose of this study is to reveal the effects of the color of PET-bottled tea beverages and their packaging labels on the taste and impression of the beverage. In this study, a subjective evaluation experiment was carried out varying the color of the tea beverage and the packaging label according to the previous study[1].

2. METHODOLOGY

2.1 Stimuli

From the measurement results of colors in 26 commercially available PET-bottled black tea beverages, three types of black tea were chosen; relatively reddish-black tea (X), common black tea as the average color in this measurement (Y), and relatively yellowish black tea (Z). Based on the experiment of the previous study[1], eight colors in bright tone in PCCS (JAPAN COLOR ENTERPRISE CO., LTD.) and three colors of achromatic colors (N9.5, N6.5, and N1.5) were used in the label colors in this experiment. Each black tea was poured into a PET bottled wrapped with those eleven kinds of colored labels. The capacity of the PET bottle was 500 ml. Figure 1 shows three types of black tea and the stimuli with common black tea (Y) in this experiment. Table 1 shows the notations and chromaticity values of each kind of black tea and each colored label of PET bottle. Thus, there were 33 stimuli in total. The stimuli were presented with the light booth in front of the participant.

Figure 1: Three types of black tea and the stimuli with common black tea (Y) in this experiment
2.2 Procedure

After several minutes light adaption by the D65 fluorescent lamp in the light booth, the participants were asked to evaluate the five kinds of impressions of taste, “visual deliciousness”, “visual sweetness”, “visual sourness”, “visual bitterness”, and “visual roasted flavor” for stimuli presented. For the visual deliciousness, its impression was evaluated with a seven-rank numerical scale (from -3: bad to +3: good). For other impressions of taste, they were used with an eleven-rank numerical scale (from 0: do not feel to 10: feel).

Also, the participants were asked to evaluate the impression of the presented stimulus using semantic differential method (SD method). In SD method, seventeen pairs of adjectives were used as shown in Table 2. It was the seven-rank scales for each pair of adjectives (i.e. for example, -3: extremely vulgar, -2: very vulgar, -1: vulgar somewhat, 0: neither vulgar nor elegant, 1: elegant somewhat, 2: very elegant, 3: extremely elegant).

Each participant evaluated each stimulus one time. They corresponded to the previous study[1]. The stimuli were randomly presented and the duration time was left to participant’s discretion. Prior to the experiment, the participants had an enough time to practice for the evaluation.

2.3 Apparatus

Figure 2 shows the apparatus in this experiment. The light booth was placed in front of the participant in the dark room. The participant sat on the chair and the stimulus was placed on the center of light booth. The participant was asked to evaluate the impression of the presented stimulus using the evaluation sheets on the clipping board. Also, the experimenter stayed behind the light booth by a black curtain separation to change the stimulus. The D65 fluorescent lamp was used and the value of illuminance was about 500 lx at the center on the light booth.

2.4 Participants

Twenty-five participants participated in this experiment. They were all male students. They have the normal color vision.

3. RESULTS AND DISCUSSIONS

3.1 Impressions of taste

Figure 3 shows the results of the impression of visual deliciousness as a function with the label colors based on all the participants’ responses. In this figure, the horizontal axis indicates the notation of label colors in shown Table 1, the vertical axis is the subjective evaluation value of visual deliciousness, respectively. The symbols correspond to the top of this figure. In this figure, the visual deliciousness of reddish black tea is lower than the others. The common black tea and yellowish black tea are evaluated visually delicious in the R, Y, and GY PET bottles. On the other hand, the visual deliciousness of all kinds of black tea is evaluated lower in Gr, Bk and B PET bottles. These results are similar to those of the previous study[1].

Figure 4 (a)-(d) shows the results of the impression of visual of sweeteness, sourness, bitterness, and roasted flavor as a function with the label colors based on all the participants’ responses as well as Figure 3. In this figure, the horizontal axes indicate the notation of label colors, the vertical axis is the subjective evaluation value of each impression as well as Figure 3, respectively. The symbols correspond to the top of this figure. In Figure 4 (a), the visual sweetness of all kinds of black tea is evaluated higher in the R, YR, and Y PET bottles. In Figure 4 (b), the yellowish black tea is relatively evaluated sour in visual. Also, the common black tea and reddish black tea in Y

Table 1: Notations and chromaticity values of each kind of black tea and each colored label of PET bottle.

| notation | PCCS | H | V | C | L* (Des) | a* (Des) | b* (Des) |
|----------|------|---|---|---|----------|----------|----------|
| X (reddish) | reddish black tea | 57.09 | 30.9 | 79.16 |
| Y (common) | common black tea | 79.91 | 9.72 | 56.85 |
| Z (yellowish) | yellowish black tea | 91.68 | -3.19 | 34.74 |
| R | b1 | 10PR | 5.5 | 11.5 | 55.63 | 49.38 | 7.56 |
| YR | b4 | 10R | 6.5 | 11.5 | 62.75 | 42.26 | 36.93 |
| Y | b7 | 2Y | 8.0 | 11.0 | 78.75 | 8.53 | 72.32 |
| GY | b10 | 3GY | 7.5 | 10.0 | 75.21 | -27.51 | 60.55 |
| G | b13 | 9G | 6.0 | 9.0 | 60.54 | -43.97 | 3.32 |
| BG | b16 | 5B | 5.5 | 8.5 | 54.68 | -20.57 | -29.16 |
| B | b19 | 6PB | 5.0 | 10.0 | 51.41 | 9.60 | -40.79 |
| RB | b22 | 7P | 5.0 | 10.0 | 48.13 | 32.37 | -26.03 |
| Wh | - | N9.5 | 95.06 | -0.02 | -2.73 |
| Gr | - | N6.5 | 65.10 | -0.87 | -5.45 |
| Bk | - | N7.5 | 19.81 | 0.55 | -2.28 |

Figure 2: Apparatus.
PET bottle looks sour. The reddish black tea is visually bitter than the other black teas. The visual roasted flavor of yellowish black tea is lower than the others. Also, that of reddish black tea and common black tea in Bk PET bottle looks more roasted flavor. They are a similar tendency to the results of the previous study[1]. It has been reported that reddish and yellowish colors visually feel sweetness and sourness, respectively[4] and the results of this experiment corresponds to that.

3.2 Factor analysis of results of SD Method

In the results of factor analysis, from the evaluations of all the participants in SD Method, a cumulative contribution ratio (Cumulative Var. in Table 2) of 55.9% was obtained for three factors. Table 2 shows the results of factor loading in these factors. The row and column indicate 17 pairs of adjectives and values of each factor loading.

As shown in table, under the first factor loading, the values of “elegant - vulgar”, “gorgeous - cheap” are highly positive. In the second factor loading, the values of “unique - common”, “interesting - uninteresting” are highly positive. In the third factor loading, the value of “soft - hard” is highly positive and that of “adultlike - childish” is highly negative. In this paper, the first, second, and third factors are called “luxury”, “originality”, and “flexibility”, respectively. It is suggested that the impression of black tea with colored label in PET bottles in this experiment can explain by the degrees of luxury, originality, and flexibility.

4 CONCLUSION

To examine the impression including the visual deliciousness with label color in PET bottled black tea, the impressions of the combination between label color and color of black tea were measured using subjective evaluation and SD method with varying the way of its combination. Three types of black tea, reddish, common, and yellowish colors, were chosen as stimuli in this experiment based on the survey of commercially available PET-bottled black tea beverages. Eleven colors for eight colors of bright tone in PCCS and three achromatic colors were selected as label colors of PET bottles. Each black tea was poured with 500 ml into a PET bottled wrapped with those eleven kinds of colored labels. The participants were asked to evaluate the five kinds of impressions of taste, “visual deliciousness”, “visual sweetness”, “visual sourness”, “visual bitterness”, and “visual roasted flavor” for stimuli presented with light booth. Also, they were
asked to evaluate the impression by SD method.

In the results, the common black tea and yellowish black tea are evaluated visually delicious in the R, YR, Y, and GY PET bottles, whereas the value of visual deliciousness in reddish black tea is lower than the others. The impression of visual of sweetness, sourness, bitterness, and roasted flavor are similar tendency of those of the previous study[1]. It has been reported that reddish and yellowish colors visually feel sweetness and sourness, respectively[4] and the results of this experiment corresponds to that.

From the factor analysis of the results of SD method, they are obtained the three factors; the first, second, and third factors are called “luxury”, “originality”, and “flexibility”; in this paper, respectively. It is suggested that the impression of black tea with colored label in PET bottles in this experiment can explain by the degrees of luxury, originality, and flexibility.

In conclusion, it was shown that both the color of the tea beverage and the color of the packaging label have an effect on the evaluation of the taste and impression. Therefore, it is hoped that PET bottle beverages will be designed in consideration of these results.

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Tabel 2: Factor analysis of the results of SD method.

| 17 pairs of adjectives | 1st fact. | 2nd fact. | 3rd fact. |
|------------------------|----------|----------|----------|
| (+) elegant - vulgar (-) | 0.864 | 0.161 | -0.039 |
| (+) gorgeous - cheap (-) | 0.801 | 0.390 | -0.246 |
| (+) healthy - unhealthy (-) | 0.675 | -0.142 | -0.134 |
| (+) relaxing - unrelaxing (-) | 0.582 | -0.358 | 0.031 |
| (+) valuable - cheap (-) | 0.575 | -0.092 | 0.006 |
| (+) natural - artificial (-) | 0.559 | -0.243 | -0.012 |
| (+) familiar - unfamiliar (-) | 0.443 | -0.387 | 0.293 |
| (+) female - male (-) | 0.436 | 0.130 | 0.356 |
| (+) warm - cold (-) | 0.211 | -0.009 | 0.028 |
| (+) unique - common (-) | -0.073 | 0.739 | -0.099 |
| (+) interesting - uninteresting (-) | 0.049 | 0.713 | 0.115 |
| (+) fancy - quiet (-) | 0.053 | 0.548 | 0.524 |
| (+) soft - hard (-) | 0.177 | -0.097 | 0.667 |
| (+) adultlike - childish (-) | 0.335 | 0.064 | -0.648 |
| (+) European - Japanese (-) | 0.035 | 0.331 | 0.491 |
| (+) modern - classical (-) | -0.065 | 0.477 | 0.480 |
| (+) brisk - depressing (-) | 0.342 | -0.106 | 0.343 |
| proportion var. (%) | 28.0 | 17.6 | 10.2 |
| cumulative var. (%) | 28.0 | 45.7 | 55.9 |