Effects of Appearance in Visual Palatability of Dishes for the Elderly under Several Lighting Conditions

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ABSTRACT

This study aims to clarify the effect of the appearance of dishes on the visual palatability for elderly people concerning its color appearance, glossiness, and visual texture. We conducted a subjective experiment on visual palatability of dishes under different light sources. We used the digital images of 12 kinds of food dishes to give the subject the same visual stimuli with no olfactory cues. As a result, we found that elderly's "visual palatability" was affected by not only the "color appearance" but also the "glossiness" of dishes.

Keywords

Elderly people, Visual palatability, Color appearance, Glossiness

1. INTRODUCTION

The appearance of food dishes is influenced by some environmental factors such as lighting. Recently, LED lamps are increasingly being installed in restaurants and houses, because their usage can reduce energy consumption and provide various light color environments. In addition, elderly people do not necessarily perceive the dishes as visually palatable as young people do, as color vision changes with age.

It was reported that some kinds of food didn't show any remarkable difference between the conventional light source (incandescent lamp or fluorescent lamp) and the LED lamp in a subjective experiment on "freshness", "appeal", "natural appearance" and "reliability" [1]. On the other hand, another study reported that the color rendering evaluations in LED lighting was lower than in incandescent light, and "fresh" and "bright" evaluation were higher with high color temperature LED light [2]. The results of a sensory evaluation of food appearance of a real product were in accordance with the results when using its photograph, in "overall color" or "color of the border", but there was disagreement in "the oily appearance" [3]. It was reported that standard illuminant D65, 5000K fluorescent lamp and 5000K LED were better suited for lighting of dishes because these lamps could make their "color appearance" better, and that LED tended to enhance "glossiness" of foods [4].

The purpose of this study is to determine the effect of the appearance of dishes on the visual palatability for elderly people concerning its color appearance, glossiness, and visual texture under different light sources in comparison with young people.

2. METHODS

We conducted a subjective experiment on the appearance of dishes by changing their lighting conditions. We prepared 12 kinds of food dishes, Sashimi (raw fish), Tempura (Japanese fritter), Teriyaki fish, Japanese omelet, Hamburger steak, Beef steak, Green pepper steak, Shrimp in chili sauce, Salad, Roll bread, Fried rice, and Mont-Blanc cake. These were chosen among those frequently served in Japanese restaurants and households and having in consideration of their characteristics in colors, glossiness, and visual texture.

We measured the colorimetric values of the 12 dishes using a 2D Color Analyzer (KONICA MINOLTA / CA-2000) under 6 kinds of light sources, 5000K and 3000K fluorescent lamp, 5000K and 3000K LED lamp, halogen lamp, and D65 lamp. Each light source was set 40 cm perpendicularly above the dish, and the illuminance on the dish was 200 lx. Next, we transformed the measured data into their respective RGB values using the calibration data of a display (EIZO / CG245W). The digital images were displayed on a calibrated monitor with the same chromaticity values as the real objects. Twenty subjects observed each image of the dishes presented on the monitor, and evaluated the "visual palatability", and answered subjectively 3 items on the appearance: "color appearance", "glossiness" and "visual texture" according to a 6 steps categorical scale. They were all homemakers with ages ranging from sixty to eighty years old.

3. RESULTS AND DISCUSSION

Figure 1 shows the average value and standard error of the evaluation results of 5 dishes under each light source. The "visual palatability" and "color appearance" of Sashimi, Shrimp in chili sauce and Beef steak are lower in the elderly in the conditions of 5000K fluorescent lamp and D65 in comparison with the young. Also, the "visual palatability" and "color appearance" of these dishes are better in the elderly in the conditions of halogen lamps and 3000K LED. "Glossiness" of Shrimp in chili sauce and Beef steak are higher under halogen lamp and LED lamps, but lower than the young. Elderly's "Color appearance" of Salad is lower than the young under most lighting conditions but "glossiness" is better under every condition. Elderly people evaluated "visual palatability", "color appearance" and "visual texture" of Tempura as high under every lighting condition, and they rated "glossiness" of Tempura significantly higher than the young.

According to the statistical analysis of above results, it was shown that the "visual palatability" was determined by not only the "color appearance" but also the "glossiness", whereas there were strong correlations between "visual palatability" and "color appearance" in the young. In addition, "Visual palatability" of Salad and Green pepper steak were statistically correlated with the "glossiness" than by the "color appearance".

These results indicate that the elderly's "color appearance" of the dishes which had red or yellow-red was good under halogen and 3000K LED lamp, and that the "glossiness" of the dishes which had green was higher correlation with the "visual palatability" than the "color appearance".

4. CONCLUSIONS

The "visual palatability" was determined by not only the "color appearance" but also the "glossiness" for the elderly. "Glossiness" could be more contributing factor to "visual palatability" in some foods, whereas "visual texture" is little affected by lighting condition in this experiment.

5. ACKNOWLEDGEMENT

6. REFERENCES

[1] Pablo Ixtaina, et al., 2010, Color appearance in LED lighting, AIC 2010 Color and Food, Interim Meeting of the International Color Association – Proceedings, pp.302-305

[2] Jin-Sook Lee, et al., 2010, A study on the proper color temperature of LED lamp in space pf dining table, AIC 2010 Color and Food, Interim Meeting of the International Color Association – Proceedings, pp.298-301

[3] Daniela Ferraris, et al., 2010, Relationship between sensory analysis and the instrumental color and visual texture assessment of deep-fried breaded veal, AIC 2010 Color and Food, Interim Meeting of the International Color Association – Proceedings, pp.112-115

[4] Shino Okuda, Yoko Fukumoto, Katsunori Okajima and Carlos Arce-Lopera, 2011, Effects of Light on Food Appearance in Color, Glossiness, and Visual Texture, Proceedings of Midterm Meeting of the International Colour Association, pp.629-632
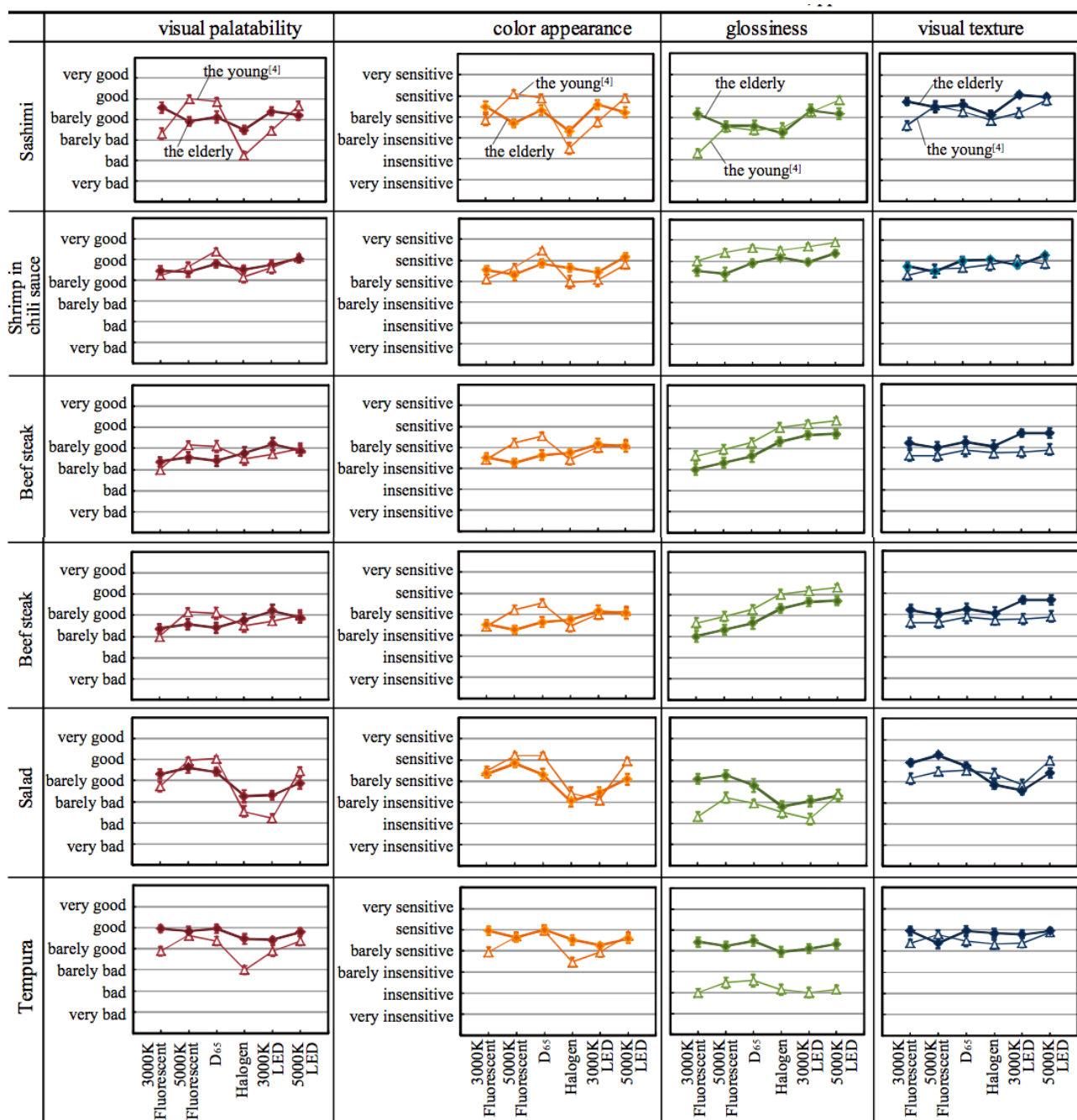

Figure 1. Evaluation results of Sashimi, Shrimp in chili sauce, Salad, Beef steak and Tempura under each light source

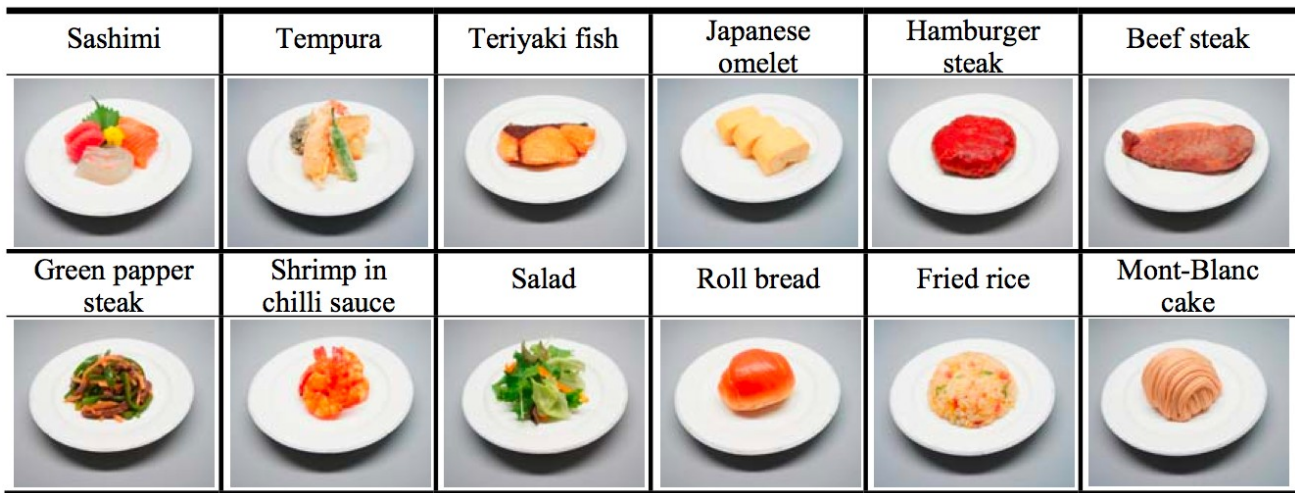| Sashimi	Tempura	Teriyaki fish	Japanese omelet	Hamburger steak	Beef steak
Green papper steak	Shrimp in chilli sauce	Salad	Roll bread	Fried rice	Mont-Blanc cake

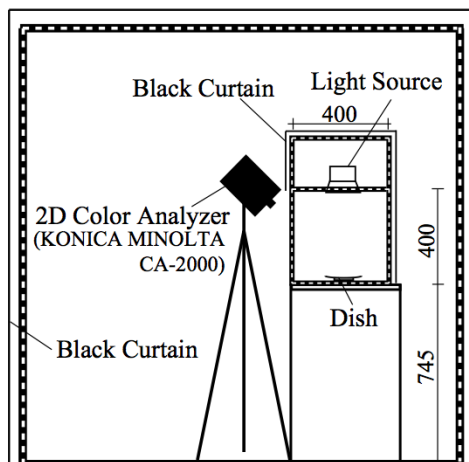Figure 2. Food dishes used as visual stimuli in this experiment
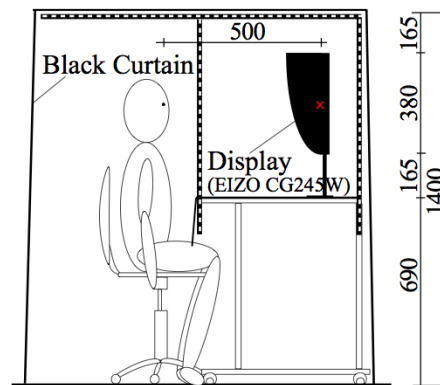
Figure 3. Measurement space

Figure 4. Experimental space

Table 1. Statistic results of Pearson's relation coefficient and Standardized Partial regression coefficient.

Statistic method	Pearson's correlation coefficient			Standardized Partial regression coefficient		
Food dishes	color appearance	glossiness	visual texture	color appearance	glossiness	visual texture
Sashimi	.813***	.669***	.518***	.724***	.103	.016
Tempura	. 761***	.559***	.541***	.612***	.151*	.101
Teriyaki fish	. 692***	.526***	.539***	.558***	.066	.139
Japanese omelet	. 743***	.644***	.470***	.599***	.210*	-.018
Hamburger steak	. 494***	.430***	.403***	.342**	.215*	.053
Beef steak	.719***	.625***	.548***	.522***	.150	.160
Green pepper steak	.645***	.751***	.394***	.218*	.645***	-.102
Shrimp in chilli sauce	.732***	.709***	.591***	.485***	.449**	-.108
Salad	.661***	.757***	.543***	.172	.562***	.111
Roll bread	.669***	.649***	.503***	.446**	.322*	-.060
Fried rice	.615***	.600***	.499***	.321**	.294*	.110
Mont-Blanc cake	.622***	.586***	.479***	.341***	.309***	.152

*p<0.05, **p<0.01, ***p<0.001