

A Study on the Effect of Color on Human Food Perception

Jingyi Huang

School of Shenzhen Foreign Languages, Shenzhen 518000, China

Abstract. The purpose of this research was to determine whether the color of food has any ability to influence and stimulate appetite. We divided the color spectrum into two broad representative groups: warm and cold colors. Based on anecdotal experiences, I hypothesized that warm-colored food would appear more appetizing than cold-colored food. To test this hypothesis, I created a survey that included images of staple food and desserts and applied different warm and cold-color filters, and asked respondents to choose their preference. Age, gender, and respondent hunger levels were also collected. The results show that staple food and desserts with warm filters attracted more overall interest, though cold-filtered desserts were notably more frequently selected than cold-filtered staple meals. The results of the research may be useful for cooking, decorating, and graphic design, and may have separate therapeutic applications for children with eating disorders.

Keywords: Color; Appetite; Experimentation; Warm colors.

1. Introduction

Given its importance to perception, scientists have researched color and its influence on behavior, frequently separating the color spectrum into two sides: warm colors, including red, orange, and yellow, and cold, including green, blue, and purple. Warm and cold colors are different in terms of their wavelengths: warm colors are long-wavelength, while cold colors have shorter wavelengths (Sokolik et al., 2014). Humans perceive these two categories of (warm and cold) differently for biological reasons (Elliot and Niesta, 2008). There are multiple ways warm and cold colors can influence perception. A previous study shows that warm-color advertisements receive higher click rates than cold-color advertisements (Sokolik et al., 2014). For the use of color in gastronomy, studies show that the color of food will affect people's judgment of how the food tastes, with one study showing that red can influence perceptions towards spicy or sweet, while orange or yellow can help create sour tastes (Spence, 2010).

Despite the number of color experiments in the literature, there are few experiments directly examining the difference between warm and cold colors in affecting our perception and appetite. In this research, I conducted a survey and asked participants to rate how likely they are to eat a food based on an image of food with a colored filter applied. Based on past anecdotal observations, I hypothesized foods that have warm-color filters will be more attractive than those with cold-color filters.

2. Method

To assess whether perceptions of appetite could be influenced by color, I designed a survey and conducted it online. I created a QR code to make the questionnaire more convenient to send to participants, and after designing the questionnaire, I posted the QR code on social media sites. I also asked friends and family to forward it to others.

The questionnaire first asked respondents about their gender and age and separated the ages into four groups. The first age group was composed of respondents ages 0-18 years, the second was 19-30 years, the third was 31-50 years, and the fourth included those older than 50. The following question asked about the respondents' appetite, with the degree of appetite divided into four levels: "Hungry," "A Little Bit Hungry," "A Little Bit Full," and "Full." This question aimed to control an individual's level of hunger at the time of an experiment.

After the demographic data, the survey asks four main questions that required participants to compare two images of a food item and select their preference. The survey provided two savory items

in hamburgers and pizza along with two pictures items in ice cream and cupcakes, with the inclusion of both savory and sweet options intended to control for variations in respondents' food preferences that might bias the results. Each image set displayed the same image of a food item twice with different filters applied using the "Snapseed" and "Procreate" apps. The first image in the set had a warm-color filter, and the second had a cold-color filter. Red and orange filters comprised the warm-color group while green and blue filters as the cold-color group. Then I asked the participants to look at the picture side by side to choose which one they felt was more appetizing.

For each picture, I randomized the choice of the specific color from warm and cold groups. For the hamburger, I used an orange filter image to compare it with the green filtered image; for pizza, I used red and blue filters; for the cupcake, orange and blue; and for the ice cream, red and green. I ordered the questions so that savory foods and desserts appeared alternately. Finally, to ensure the usability of the results, the survey required participants to answer each question with no options for neutral or ambiguous choices.

3. Results

A total of 105 participants filled out the questionnaire. 39% were male and 61% were female. Respondents' age varied. Most respondents were in the under 18 group (44%) or the 30-50 age group (37%), with minority numbers in the 19-30 group (13%) and the over 50 years group (6%). 40% of respondents reported feeling "A Little Bit Hungry" while 42% of people said they were "A Little Bit Full" full. Only 6% responded as feeling "Hungry" and 12% responded as feeling "Full."

Our primary data concerned the filtered image selection, and for each food item, the majority chose the warm-colored filtered versions. 87% of respondents chose the orange-filtered hamburger over green filters, 62% chose the orange-filtered cupcakes over the blue filtered, 70% preferred the red-filtered pizza over the blue filtered, and 55% preferred the red-filtered ice cream over the green filtered.

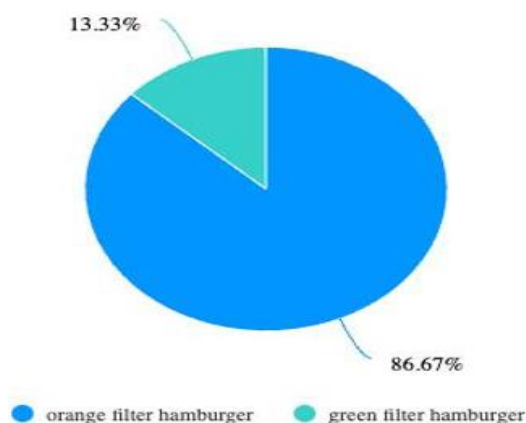


Fig 1. Percentage of respondents choosing the color-filtered hamburgers.

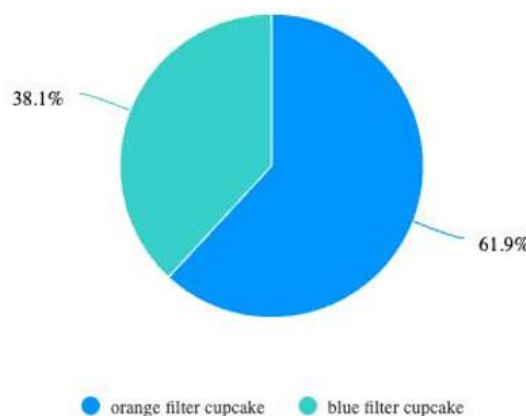


Fig 2. Percentage of respondents choosing the color-filtered cupcakes.

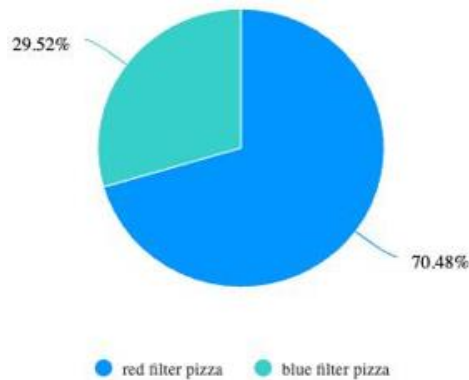


Fig 3. Percentage of respondents choosing the color-filtered pizza.

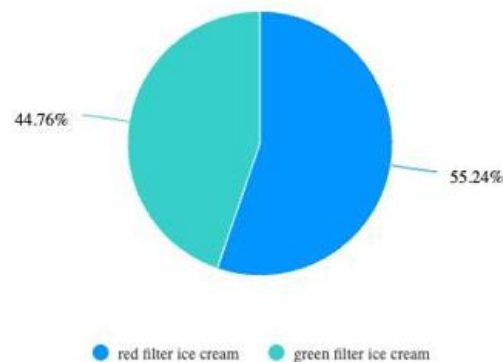


Fig 4. Percentage of respondents choosing the color-filtered ice cream.

To determine whether respondent appetite had effects on respondents' bias for color filters, I built cross-tabulations comparing respondent appetite levels against their indicated filter preference.

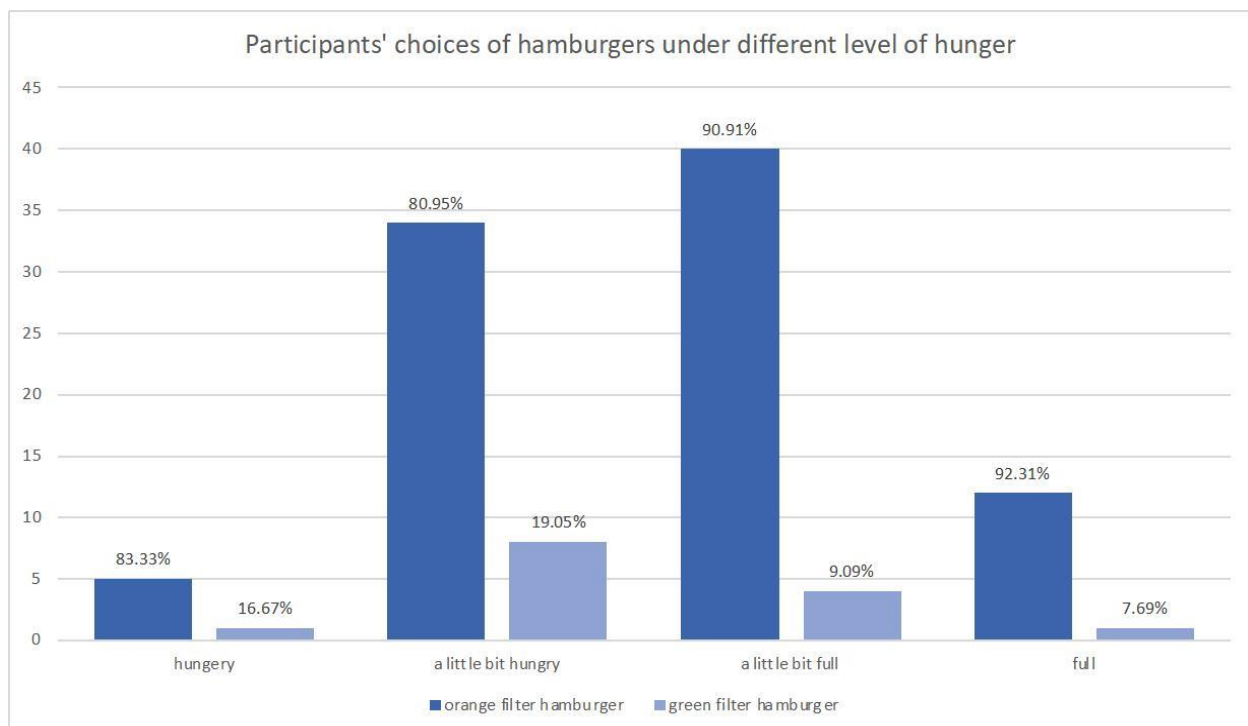


Fig 5. Respondent preferences for warm or cold-filtered hamburgers by appetite level.

In Figure 5, we can see that no matter which level of hunger, the percentage of choosing the warm-color filtered hamburger is higher than 80%.

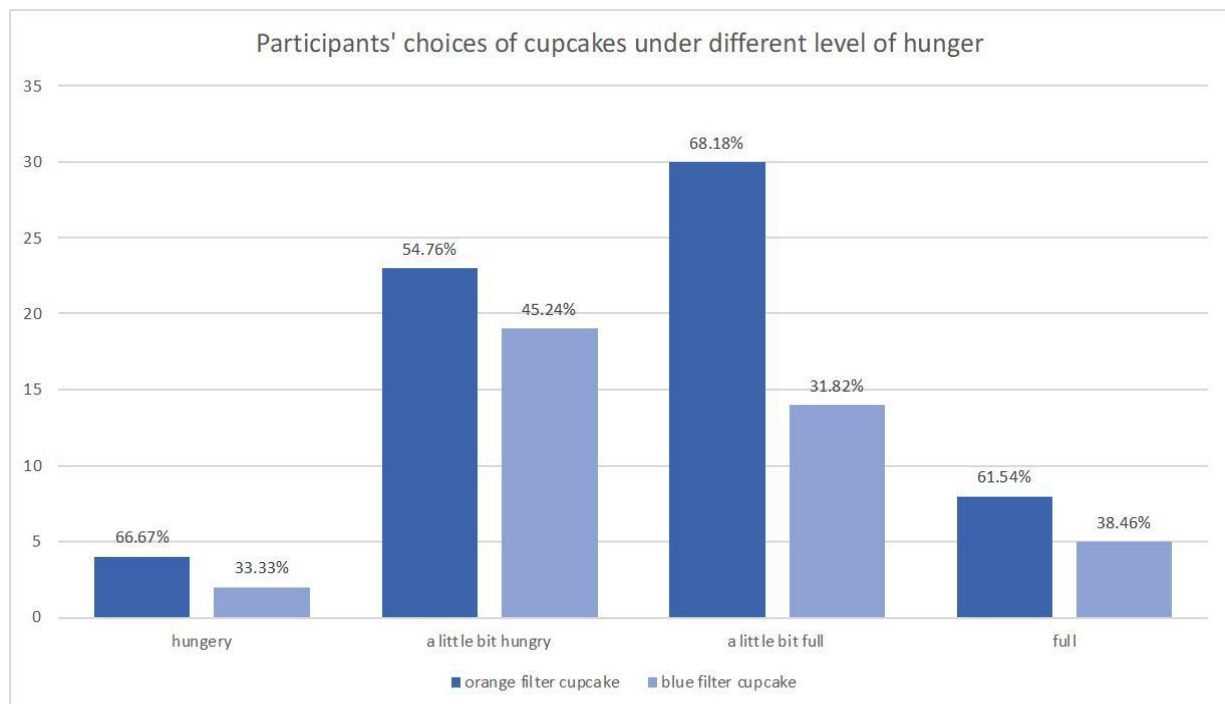


Fig 6. Respondent preferences for warm or cold-filtered cupcakes by appetite level.

Figure 6 shows that although the warm-color filter was more popular for cupcakes, the percentage of cold-color filters notably increases. In the “A Little Bit of Hungry” group, the percentage of choosing a warm-color filter decreases from the hamburger’s 81% to the cupcake’s 55%, a difference of 26%.

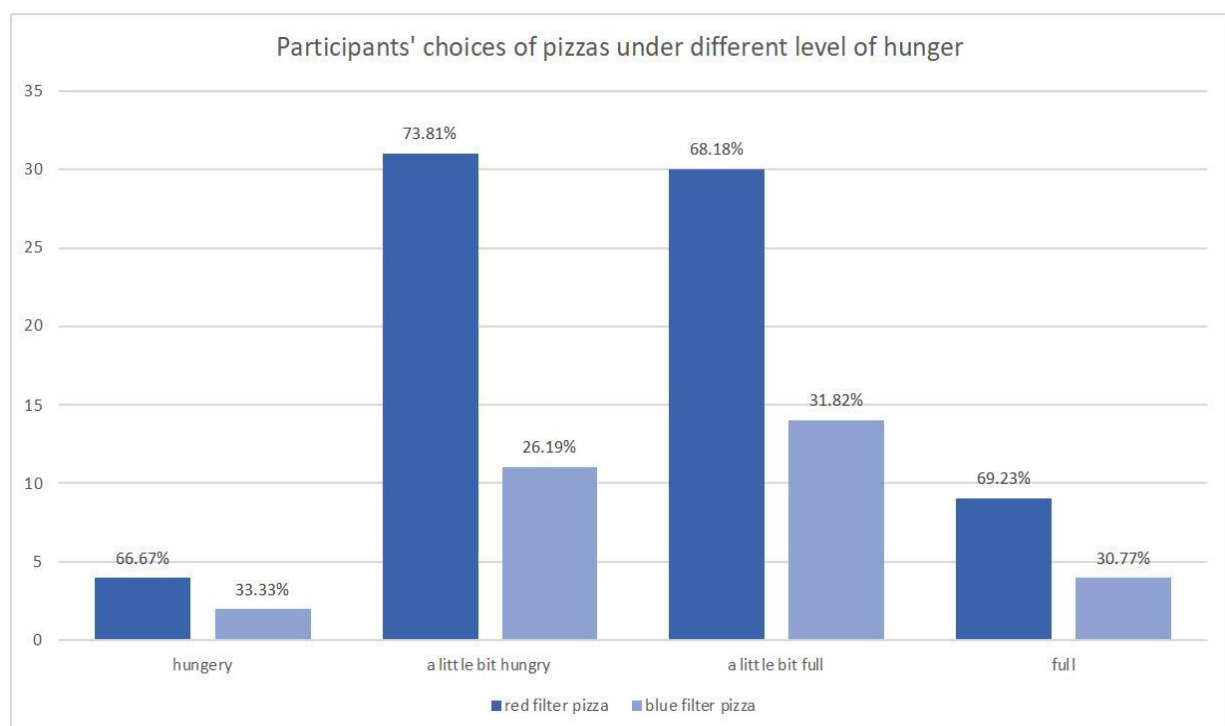


Fig 7. Respondent preferences for warm or cold-filtered pizza by appetite level.

For pizzas, people who are “A Little Bit Hungry” offers other diverges in the data, where compared to the cupcakes, the preference for the warm-colored filter rises from 55% to 73%. For other groups of people, the percentage doesn’t significantly vary.

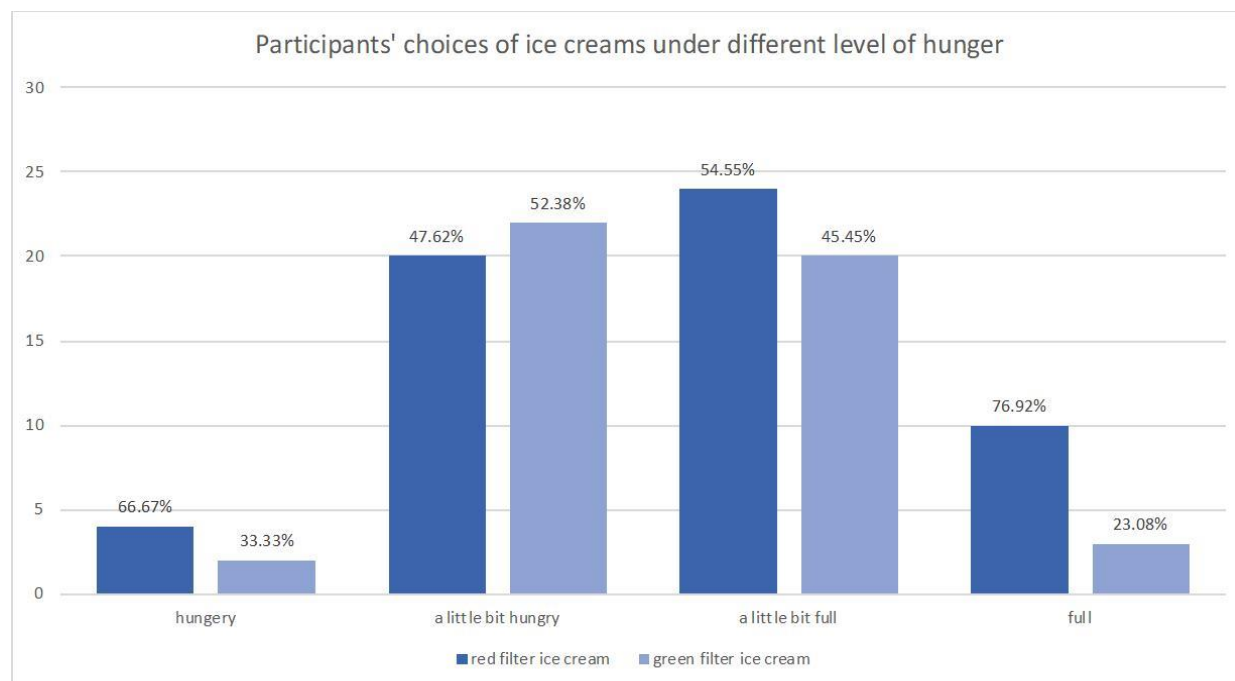


Fig 8. Respondent preferences for warm or cold-filtered ice cream by appetite level.

Figure 8 demonstrates that for ice cream, warm colors are generally preferred except for the “A Little Bit Hungry” group, where the green cold-color filter was preferred. None of the four groups have a percentage above 80% for either choice.

The four graphs show that overall, there is a strong tendency among respondents to favor the warm-color filtered images, and except in the case of respondents who were “A Little Bit Hungry” responding to desserts. The preference for warm-colored filters among staple foods is striking, with the warm-color preference ranging between 67% and 93%.

4. Discussion

The results demonstrate that for all four scenarios, individuals preferred foods with warm-color filters over cool-color filters. From these results, we can conclude there is a general tendency in individuals to prefer eating food with warm-color themes compared to cold-color themes. In other words, foods with warm colors are more appetizing in appearance. As colors were varied and represented across all the options, individual preferences did not owe to individual preference for a specific color.

The main caveat to this conclusion to the results is that for desserts, the difference in color-filter preferences wasn't as significant as it was for staple foods. This is particularly notable in the results for filtered ice cream preferences, where the preference for warm colors holds a relatively slim majority, and in one appetite level group, the cold filter was even preferred, albeit by a small majority. There are possible ice-cream-centric explanations: some individuals may have found the red-filtered ice cream to be less appetizing because ice cream is less likely to be red, while green-filtered ice cream is not uncommon as pistachio and green tea flavors.

These results are significant in looking at how colors can influence food choice or appetite, and potential applications are broad. Chefs can choose to use different colors during cooking to make their productions seem more flavored and appealing to appetites. Cold colors may have some unseen benefits, most likely for desserts like ice cream, but our study does not conclusively address this, and any ideas for their uses would be speculation. Beyond the food itself, culinary artists can use decorations to change the atmosphere of the dish, helping beautify foods that are generally cold-color in appearance due to their materials with warmer contexts.

Beyond cooking, the results of this survey offer insights and inform therapeutic practices in helping children with picky eating habits and those with intake disorders like ARFID. Previous research indicates that ARFID is a common problem in children, with between 14% and 50% of preschool children having picky eating habits and between 7% and 27% of older children (Norris, M. L., Spettigue, W. J., & Katzman, D. K., 2016). ARFID is of particular concern as it can pose multiple problems to children's growth, especially for those under three years old, where a picky eating habit increases the risk of being underweight (Ekstein, S., Laniado, D., & Glick, B., 2010). Research shows that the pleasure of eating is the most important aspect in averting such issues, and remedies that don't focus on pleasurable eating, like applying too much pressure on children to force them to eat vegetables, may result in worse eating habits and a negative relationship with food (Van der Horst, K., 2012). To change children's diet habits positively, parents can mix vegetables, which usually have cold colors, with warm-colored food, like meats, or by adding healthy sauces to change the vegetable's color.

Future opportunities for research exist. This study, with few respondents, could be expanded with more respondents, which would make the results available for analysis with statistically significant results, and specific color options could be used. With enough respondents, more varieties of comparisons could be drawn, like red versus green, red versus blue, etc. This research proposes a foundation upon which future color research can continue.

References

- [1] Ekstein, S., Laniado, D., & Glick, B. (2010). Does picky eating affect weight-for-length measurements in young children? *Clinical pediatrics*, 49(3), 217-220.
- [2] Elliot, Andrew J., and Daniela Niesta, (2008), "Romantic Red: Red Enhances Men's Attraction to Women," *Journal of Personality and Social Psychology*, 95, 1150–1164
- [3] Norris, M. L., Spettigue, W. J., & Katzman, D. K. (2016). Update on eating disorders: current perspectives on avoidant/restrictive food intake disorder in children and youth. *Neuropsychiatric disease and treatment*, 12, 213.
- [4] Sokolik, K., Magee, R. G., & Ivory, J. D. (2014). Red-hot and ice-cold web ads: The influence of web ads' warm and cool colors on click-through rates. *Journal of Interactive Advertising*, 14(1), 31-37.
- [5] Spence, C. (2010, March 9). Does Food Color Influence Taste and Flavor Perception in Humans? SpringerLink. https://link.springer.com/article/10.1007/s12078-010-9067-z?error=cookies_not_supported&code=fe5aae0e-2354-4419-8c17-094d0809e779.
- [6] Van der Horst, K. (2012). Overcoming picky eating. Eating enjoyment as a central aspect of children's eating behaviors. *Appetite*, 58(2), 567-574.