Consumers' Attention Allocation on the Food Packages: An Eye-Tracking Study

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Abstract: Processed food is very popular nowadays for its convenience, which helps people to save time. Moreover, its taste is generally satisfactory. The ingredient section and nutrition facts on food packages are important resources for consumers to access food health information. However, there are many other elements on food packages besides these. How people allocate attention when viewing food packages reveals their awareness of food health. To identify people's gazing behaviors during food package visual processing, this study recruited 16 participants to view food package images. The process was recorded via an eye-tracker. The eye-tracking technology could provide quantitative and accurate data on people's gazing behavior. The data could reveal people's visual attention to the ingredient section and the nutrition facts. Apart from the whole nutrition facts table, some key items (e.g., the sodium content and calories), were also investigated. Statistical analyses showed that people paid significantly more attention to other elements on food packages instead of to the food health-related information, which indicated people had comparatively lower food health awareness. Food health awareness should be improved for the future. At the same time, to increase the exposure of the ingredient section and the nutrition table, the package design and layout could be modified, including increasing the font size or adding labels and images.

Keywords: Eye-tracking, food package, food ingredient, gender, sodium content, calories, nutrition, attention

1. Introduction

With the rapid development of the food industry and the acceleration of people's pace of life, prepackaged food has become an integral part of residents' daily diets. Consequently, the safety, hygiene, and nutrition of prepackaged food have increasingly captured people's attention[1] . The ingredients list and nutrition information serve as the most convenient means for individuals to understand food composition and nutritional content[2] . In several countries, including China, the United States, the European Union, Canada, Australia, New Zealand, and Japan, food producers are required to label nutrition composition tables [3]. Some of these countries have even more stringent policies, mandating the labeling of trans fatty acids and specifying the content of vitamins and minerals in the ingredient list. Recently, the Ministry of Health of China issued multiple versions of "The Standards for Prepackaged Food Labeling," with stricter and more detailed requirements regarding the use and labeling of food additives and ingredients[4] .

Prior studies have revealed that Chinese consumers pay inadequate attention to the nutrition information of food and lack a clear understanding of the meaning behind the ingredients in the ingredient list[5][6] . However, in recent years, an increasing number of people have started to prioritize food health, focusing on ingredients and calorie content. This trend may be attributed to the growing awareness and concern about health issues, as well as the proliferation of body anxiety information on social media platforms[7] . Consequently, some individuals have begun to scrutinize the nutrition list to avoid consuming "unhealthy" and high-calorie, low-nutrition food items. To investigate how Chinese consumers pay attention to the ingredient and nutrition information of processed food, this study was conducted. While previous research on the nutrition composition list primarily relied on questionnaires and interviews [8][9], this study adopted a more accurate and objective method—the eye-tracking technology. The eye tracker captures participants' gaze and generates quantitative results, providing insights into their attention, psychological activities, and cognitive processes. This technology has been widely employed across various fields [10]. In this study, an eye tracker was utilized to record

participants' gazing behavior while viewing food packages, which contain various types of information, including nutrition facts and ingredients. The findings can shed light on how people allocate their attention, especially to health-related components, such as the ingredient section and the nutrition facts. Furthermore, gender differences are analyzed to determine if females and males exhibit different gazing behaviors. People's attention to the ingredient and nutrition sections can reflect their awareness of food health. The research outcomes can also offer valuable insights for food packaging design.

2. Methods

2.1 Participants

The study comprised a sample of 16 participants, with an average age of 25.52 (SD=9.79). The sample consisted of 8 males and 8 females, all randomly recruited from a mall in Shanghai, China. Prior to the experiment, participants were informed that it was a social experiment involving viewing a series of photos. They were also informed about the use of an eye tracker and the associated potential risks. As an incentive, desserts were offered as gifts upon completion of the experiment. All participants willingly agreed to take part in the study and signed the consent form.

2.2 Stimuli

Two images of self-heated rice food packages were chosen as visual stimuli. Each image of the backside contains the ingredient section and the nutrition facts, denoted as Picture1 and Picture2, respectively. The backside is divided into three parts from left to right: the list of ingredients, instructions on how to properly prepare the rice, and the nutrition facts. Each part occupies one-third of the package.

2.3 Design and Procedure

Prior to the experiment, participants were not informed that it was an eye-tracking experiment, and they would be shown several food packaging pictures. The experiment was conducted in a café setting, where participants willingly signed the consent form and agreed to participate voluntarily. Personal information, including gender and age, was also collected. Afterward, participants were guided to sit facing a screen equipped with an eye-tracker (Tobii 4C) positioned at the bottom. The eye tracker and screen were connected to a laptop with Tobii Pro Lab software installed. To ensure accurate gaze capture, participants underwent a nine-point calibration procedure. Once successful calibration was achieved, the experiment commenced. Participants were instructed to keep their heads and bodies still and stare at the screen throughout the experiment. Each session displayed two images automatically, with each picture lasting for 20 seconds. All participants viewed the same image sequence.

The areas of interest (AOI) within each image were categorized into five sections: the ingredient section, the cooking steps (referred to as "Other"), the nutrition facts, the sodium content in the nutrition facts, and the calories in the nutrition facts.

2.4 Data analysis

The purpose of the study is to investigate the distribution of people's attention to food packaging, with a particular focus on the ingredient section and the nutrition facts. To compare participants' gaze patterns across different Areas of Interest (AOIs), ANOVA tests were conducted among the ingredient section, Other elements, and the nutrition facts. Additionally, ANOVA analyses were performed on each item within the nutrition facts to identify participants' attention to the sodium content and calories. To determine if there are differences in gaze behaviors between females and males, T-test analyses were also conducted for the two genders. Eye-tracking parameters, including Total Fixation Duration (TFD) and Fixation Counts (FC), were utilized to quantify participants' attention to specific areas of interest.

3. Results

3.1 TFD analyses of the ingredient section, the nutrition facts and Others

As Table 1, the results of ANOVA analyses showed that there was no significant difference in the

total fixation duration between the nutrition list (M=1.29, SD=1.75) and the component list (M=1.91, SD=2.42), but the total fixation duration of Others (M=11.32, SD=4.91) was significantly higher than that of the nutrition section and the ingredient list (F=40.15, p<0.05).

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3.2 FC analyses of the ingredient list, nutrition list and Others

As Table 1, the results of ANOVA analyses showed that there was no significant difference in the fixation counts between the nutrition list (M=4.05, SD=5.91) and the component list (M=5.31, SD=7.57). However, the fixation Counts of Others (M=42.55, SD=17.58) was significantly higher than that of the nutrition list and the ingredient list (F=71.58, p<0.05).

Table 1 TFD and FC results in the ingredient list, the energy proportion and Others

AOI	TFD(s)	FC
Ingredient List	1.91	5.30
Nutrition list	1.29	4.05
Others	11.32	42.55

3.3 TFD and FC analysis of the ingredient list between females and males

Furthermore, as Table 2, T-test results were conducted to examine potential gender differences in fixation duration and counts. The analysis revealed no significant differences in the total fixation duration between the male group (M male =0.93, SD male =1.37) and the female group (M female=1.16, SD female =1.43 ; t=1.75, p >0.05) when looking at ingredient list. Similarly, no significant differences were found in the fixation counts of participants in the male group (M male =2.44, SD male =3.98) and the female group (M female=7.63, SD female =9.21; t=1.76, p >0.05) when looking at ingredient list.

3.4 TFD and FC analysis of the nutrition list between females and males

As Table 2, no significant differences were observed in the total fixation duration between the male group (M male =0.64, SD male =1.21) and the female group (M female=0.78 , SD female =0.98; t=1.77, p >0.05) differences when looking at the nutrition list. Likewise, there were no significant differences in fixation counts between the male group (M male =1.89, SD male =3.22) and the female group (M female=5.82 , SD female =7.10 ; t=1.73, p >0.05) when looking at nutrition list.

3.5 TFD and FC analysis of Others between females and males

As Table 2, T-test results showed that the total fixation duration of participants in the male group (M male = 12.25, SD male =4.61) and the female group (M female=11.89, SD female =4.60; t=1.75, p >0.05) did not show significant differences when looking at Others. And the fixation counts of participants in the male group (M male =36.89, SD male =11.92) and the female group (M female=41.78, SD female =20.51; t=1.75, p >0.05) did not show significant differences when looking at Others.

3.6 TFD and FC analysis of the energy proportion

The results of ANOVA analyses showed that there was no significant difference in the total fixation duration between the energy proportion and other components in the nutrition facts (M=0.30, SD=0.58, F=0.34, p>0.05). There was also no significant difference in the fixation counts between the energy proportion and other components in the nutrition list (M=0.85, SD=1.72, F=0.24, p>0.05).

3.7 TFD and FC analysis of the sodium proportion

The results of ANOVA analyses showed that there was no significant difference in the total fixation duration between the energy proportion and others components in the nutrition list (M=0.17, SD=0.18, F=0.34, p>0.05). There was also no significant difference in the fixation counts between the energy proportion and other components in the nutrition list (M=0.60, SD=0.82,F=0.16,p>0.05).

Table 2 TFD and FC results of the ingredient list, the energy proportion and Others(male and female)

AOI	TFD (s)		FC	
	Male	Female	Male	Female
Ingredient List	0.93	1.61	2.44	7.64
Nutrition list	0.64	0.78	1.89	5.82
Others	12.26	11.89	36.89	47.18

4. Discussion

The purpose of this research is to investigate people's gazing behavior when viewing food packages, which can provide insights into their attention distribution among different components, especially the ingredient section and the nutrition facts. Through ANOVA analyses of the ingredient list, the nutrition table, and the cooking instructions, it was observed that both the fixation duration and fixation counts for the cooking instruction part were significantly higher than those for the other components and the nutrition facts. However, no significant difference was found between the ingredient portion and the nutrition table, indicating that people paid relatively less attention to ingredient and nutrition-related information when viewing food packages. Furthermore, there was no significant difference in how people viewed each item in the nutrition list, including the sodium content and calories, which are crucial factors related to health issues nowadays.

Interestingly, people tend to overlook the nutrition facts and ingredients, even though these sections occupy relatively significant portions on the package. This aligns with a previous study that suggested consumers lack attention to the nutrition part when purchasing food[8]. The probable reason for this oversight is a lack of awareness regarding food health. Individuals do not realize that these sections provide essential information about the nutritional value of the food they are consuming. Among all items in the nutrition facts, people's attention is evenly distributed, indicating that they do not randomly view the table. This finding is consistent with a study published by the American Dietetic Association (ADA), which reported that only 9% of participants actually read calorie data for almost all products, and only 1% looked at all four ingredients listed (total fat, trans fat, sugar, and use per serving) on nutrition labels. The sodium content and calories are two critical aspects related to health issues. Chen [11] pointed out in an article that excessive sodium intake increases the possibility of high blood pressure, a condition affecting over 30% of Chinese residents. This issue may be closely related to dietary habits, such as excessive salt usage during cooking and high salt contents in many prepackaged foods. People with hypertension or those aiming to prevent it through a low-sodium diet should pay attention to the salt amount used when cooking at home and the sodium content of prepackaged foods. However, this study found that people did not pay significant attention to the sodium content.

The t-test results for the fixation duration and counts between males and females did not show any significance, suggesting that there were no notable gender differences in how they viewed the nutrition and component lists of commodities. This differs from Jia's study , which indicated that women pay more attention to food composition and nutrition than men. The potential reason could be that the food product adopted in this study is self-heating rice, where people prioritize convenience over other factors. It is possible that different food product types, especially snacks or high-calorie foods, may show significant gender differences.

Based on the results of this study, it is evident that people lack awareness regarding paying attention to the nutrition and ingredient information of processed food. Raising their awareness is crucial. Additionally, food packaging design may inadvertently lead people to overlook the component and nutrition parts. Currently, most nutrition and composition lists on food packages are presented in text form, often with small font sizes. Manufacturers should improve the design of product composition lists and present nutrition information in a more visual and easy-to-understand manner[12] . For

example, increasing font sizes, adding images, or labels can make it more visually appealing.

Further research could be enhanced in several ways. Firstly, as discussed above, different types of food products may yield varying results. Therefore, further studies should include and compare more food types, such as low-calorie foods and high-calorie foods, vegetables and fruits, snacks, and main courses. Additionally, exploring methods to increase people's health awareness, encouraging them to pay more attention to the ingredient list and nutrition table when buying food, and improving food packaging design to increase the exposure of ingredient and nutrition information also warrant investigation.

5. Conclusion

The current study employed eye-tracking technology to assess participants' attention towards food packages, with a particular focus on the ingredients list and the nutrition facts. The participants were presented with images of two packages of self-heated rice, while their gazing behaviors were recorded using an eye tracker. Quantitative analysis of the eye tracking data indicated that individuals do not prioritize the ingredient list and the nutrition facts when viewing food packages. The results suggest that people have lower awareness of food health and may struggle to extract relevant health-related information from these sections.

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