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Original Article

Effects of Visual Aspects on Consumer Preferences in The Health Supplement Market by Eye-Tracking

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Abstract

Health dietary supplements compared to prescription drugs are different in deciding to consume and the end user is the main decision maker. Packaging plays the most important role in product marketing and branding in the nutritional supplement industry. Packaging shape and color can impact a decision to buy as well as identify what type of item it is and whom it is made for. Packaging factors such as color and shape are important in clinical and marketing aspects. Many types of research on the effect of packaging on psychology or marketing aims have been investigated. This study aimed to evaluate consumers' preferences for color and shape in oral solid dosage forms (OSDF) by eye-tracking technique. Eye movements are directly correlated to feelings, attention, learning, and reminding of an advertisement or product. This study tried to find consumer preferences by considering eye movements. This study includes two parts: evaluating the independent impact of color and the independent impact of shape on drowning the participants' attention by tracking the eyes. Thirty participants (15 men and 15 women, aged 20 to 50) with normal and full-color vision participated in the experiment. Images with a neutral (grey) background including 8 colors for each tablet form were made based on previous studies. Images with a neutral (grey) background including 8 shapes for each color were made. Shapes were selected based on the most current shapes used in the pharmaceutical industry. The images were shown to participants and their eye movements were collected by eye tracking device (TobiiT60). The descriptive data analysis indicated that white is the most favored color among the sampling population with a mean vision time of 2252 milliseconds. On the other hand, the pink color was selected as the least favored. For shapes, descriptive analysis of data indicated that the hard gelatin capsules are the most favored dosage form among the sampling population with a mean vision time of 1238 milliseconds. On the other hand, pearl 1 was selected as the least favored compared to other shapes with a mean vision time of 992 milliseconds. Based on the results of this research, the preferable form of general dietary supplement is small and white totally. The results indicated that white color is the most favored color and pink color is the least favored one. In addition, the hard capsule was selected as the most favored dosage form while the pearl was selected as the least favored one. No significant difference between men and women groups was observed. This may be important for pharmaceuticals to produce medicines with the most preferences for both clinical and marketing aspects. Color is the most preferred characteristic with the perception that color is related to the therapeutic indication of supplements. Shape and size can affect preferences regarding the compliance of patients.

Keywords: Visual Aspects; Consumer Preferences; Food Supplements; Eye-Tracking; Neuromarketing.

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1. Introduction

Over-the-counter drugs (OTC) including health dietary supplements compared to prescription drugs are different in deciding to consume. Prescribers or physicians are decision-makers in prescription drugs, but for supplements, the main decision maker is retail or end consumer [1].

Hence previous studies showed that choosing an OTC is in the low-risk categories of products, consumers don't need detail of products such as adverse effects or active ingredients to decide. In these categories factors related to cognitive aspects such as graphics (shape, color, and texture) have more effect than logic factors such as ingredients and price [2]. Therefore, marketing activity for consumers can influence making decisions in the supplement market. Packaging plays the most important role in product marketing and branding in the nutritional supplement industry. Package shape and color can impact a decision to buy as well as identify what type of item it is and whom it is made for. Packaging factors such as color and shape is important in clinical and marketing aspects of the manufacturing of supplement [3]. There are several Researches had investigated the effect of packaging on psychology or marketing aims; however, fewer studies have tried to understand consumers' preferences in oral solid dosage forms (OSDF) [4]. One research demonstrated the use of white color tablets regarding a preference effect [5]. Although, in a survey, it has been revealed that more than 50% of the patients select white as their preferred color for tablets [6].

The pharmaceutical industry is increasingly recognizing the needs of individuals who experience difficulties taking conventional tablets and is responding with products that are easier to swallow and more convenient to take. Similar to fast-moving consumer goods (FMCG), for OTC supplements, it is important to ensure that a product's packaging is easily visible and recognizable and that it differentiates the product from the competition [7].

Marketing specialists use color experts and graphic designers to choose the best color and shape for their products. It was shown that color advertising and packaging attract audiences 15 times more than black-and-white forms [8]. Furthermore, it was found that various colors of OSDF may be understood to be related to some pharmacological properties like rapidity of action, effectiveness, or site of action inside the body [9,10]. Based on associative learning mechanism theory, factors of shape and color can be related to preferences. This theory explains how the surrounding environment affects the events [11]. Within this mechanism, it can be assumed that the shape and color of oral solid tablets or capsules can be stimulants for consumers to choose a supplement that has the best efficacy [9,12]. Regarding the placebo effect, if the color of the medicine was not correlated to the perceived effects, patients do not respond very well [13]. This study was conducted to determine what color and shape are more acceptable to consumers of supplement products.

Several studies showed that the oral solid forms, which they predict to pass the esophagus more easily, are considered as easy swallowed medications by patients too [6]. On the other hand, visual aspects of supplements such as shape can be helpful to recognize and differentiate supplements; furthermore, aesthetic considerations are very important to the acceptability of customers (37). Patients' acceptance and compliance depend on the visual appearance of the tablet [14].

Attractive colors and shapes are not separated from the main goal, the color used in packaging causes the recall of products for customers, it was called marketing, 'Recall' [15]. Another study shows that color has more effect than shape [16].

1.1. Eye tracking method

The main idea of eye tracking is identifying vision and attention [17]. Eye movements are directly correlated to feelings, attention, learning, and reminding of an advertisement or specifications of a product [18,19]. Some Studies showed that eye movements are comparable with cognition [20]. It's investigated that eye movements are strongly dependent on decision tasks, which could be related to cognitive behaviors [21]. In marketing studies, eye movement evaluations are considered indicators in situations where someone is stimulated by viewing a product. In this way, the data is gathered quickly, indirectly, and in a non-invasive way [22]. Various measures such as fixation count, time to first fixation, and especially fixation duration can be used to investigate the gazing behavior. These measures can explain and predict choice behavior [23]. The eye-tracking technique is rarely used in marketing research in the dietary supplement industry. In studies with a goal-oriented attention approach, they have focused on specific tasks to evaluate the effectiveness and purchase willingness of a product [24]. The eye-tracking technique is also used to determine food visual stimulating factors including color and shape [25], or customer conception of quality aspects such as effectiveness [26]. Furthermore, eye-tracking powerfully contributed to the study of aspects that affect consumer behavior [27, 28], decision goals [29], and thinking style [30].

1.2. Eye movement measures

The eye fixation pattern reveals how consumers distinguish information from an image. In this study, fixation duration measurement is used to evaluate consumer gazing behavior. Fixation duration is the total time of eye fixation on an area of interest (AOI) which is the most sensitive measure to process cognition [31].

This study aimed to investigate what colors or shapes for solid dosage forms are most preferable by consumers. In addition, it investigated the preferences of women and men in drug choice.

2. Materials and Methods

This study includes two parts, the first part was done to evaluate the independent impact of color on the eye movement of customers and decision time. The second part investigates the impact of shape on the customers' attention.

2.1. Participants

Thirty persons (15 men and 15 women, aged from 20 to 50) with normal and full-color vision participated in this research. They were selected from customers of three pharmacies in Tehran, the capital of Iran.

The study was done based on the ethical guidelines of academic research. Candidates participated in the study voluntarily and without any incentive. They were informed about the test before starting and they were allowed to exit the study at any time.

2.2. Stimuli

To achieve eight similar stimuli for each part of the experiment, a scientific method was used. Similar images with the same brightness and size are generated by Adobe Photoshop.

2.2.1. Part 1: investigating colors

Images with a neutral (grey) background included 8 colors for each tablet were designed. Selected colors were blue, purple, yellow, red, white, green, brown, and pink by earlier studies [32].

2.2.2. Part 2: investigating Shapes

Images with a neutral (grey) background included 8 shapes for each color were made. Shapes were including a caplet, round tablet, triangle tablet, oval tablet, soft capsule, hard capsule, and two kinds of pearl the most current shape used in the pharmaceutical industry.

2.3. Test design

Since the objective of this study was to define which color and shape design affect customer gazing behavior, two separate parts were created.

Before starting the experiment, a nine-point calibration technique was used to be ensured about healthy eyes of participants/subjects. Calibration points were dispersed throughout the viewing field for maximum accuracy. Subjects were instructed to sit as still as possible and avoid large head movements. The participants were told to choose an appropriate supplement. After completing the calibration procedure, the stimuli were shown. In part 1, choosing the best color, 8 images were displayed in the shape of the drug that was invariable and the colors were variable in the image (for example in one image 8 capsules with different colors were shown). Each image was shown 3 times, while the location of drugs in the image changed randomly. Based on the high-pressure theory each image was shown for 3 seconds [33]. In part 2, for choosing the shape, 9 images were displayed in which the color of the drug that was invariable, and the shapes were variable (for example in one image 8 grey shapes were shown). Other details are similar to the first part.

The instrument of the study is an Eye Tracker called Tobii T60. It was used to collect participants' eye movements as well as preferences. It is a binocular system with a sampling rate of 60Hz and a processing latency of <17ms. A high-resolution 15-inch widescreen monitor, with 1920 x 1080 pixels was used to display images. Participants were asked to sit at a distance of approximately 65 cm from the sensor of the Tobii T60 device. For getting better results a solitary location was prepared for participants. The data were analyzed using IBM SPSS 23 software.

3. Results and Discussion

3.1. Color

A descriptive analysis of data (**Table 1**) for the time of vision for each color indicated that white color is the most favored color among the population with a mean vision time of 6758 milliseconds. On the other hand, the pink color has been selected as the least favored color compared to other colors with a mean vision time of 1283 milliseconds. The other colors were placed at the same rank (**Figure 1**).

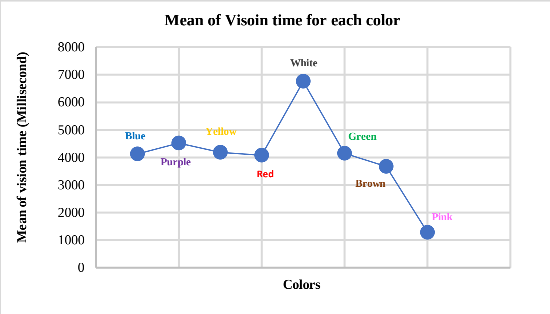

Figure 1: Mean of vision time for each color.

Utilizing ANOVA statistical test, it has been clarified that there was a statistically significant difference among different color groups in terms of mean vision time (**Table 2**).

Although there were significant differences between white and pink compared to other groups, no significant difference has been demonstrated among the other colors (**Figure 2**). In addition, no significant difference between men and women groups was observed.

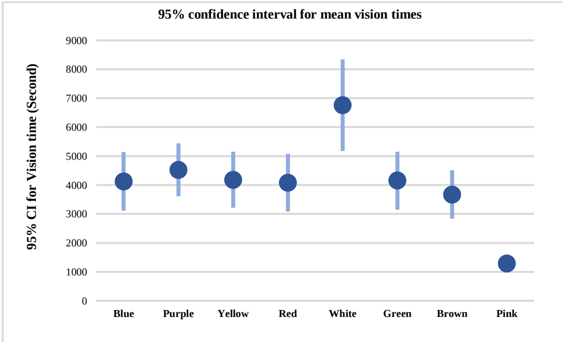

Figure 2: 95% confidence interval of mean vision times for each color.

Table 1: Descriptive analysis of vision time for each color.

Color	N	Mean	SD	95% Confidence Interval	Min	Max
Blue	29	4123	2662	3110 - 5136	98	9687
Purple	28	4524	2355	3610 - 5437	473	8795
Yellow	29	4182	2542	3215 - 5149	191	7734
Red	30	4074	2666	3078 - 5070	67	9420
White	28	6758	4084	5174 - 8342	232	14658
Green	29	4150	2626	3151 - 5148	198	8519
Brown	29	3673	2204	2834 - 4511	133	6893
Pink	1	1283	--	--	1283	1283
Total	203	4468	2904	4066 - 4870	67	14658

Table 2: ANOVA test for the difference in vision time among different color groups.

Groups	Sum of Squares	df	Mean Square	F	Sig.
Between	188785003	7	26969286	3.471	0.002*
Within	1515183365	195	7770171	--	--
Total	1703968369	202	--	--	--

* Indicated significant differences

3.2. Shape

Descriptive analysis of data for the time of vision for each shape (**Table 3**) indicated that the hard capsule is the most favored dosage form among the population with a mean vision time of 3716 milliseconds. On the other hand, the pearl 1 has been selected as the least favored in comparison with other shapes with a mean vision time of 2976 milliseconds. The other shapes were placed at the same rank (**Figure 3**).

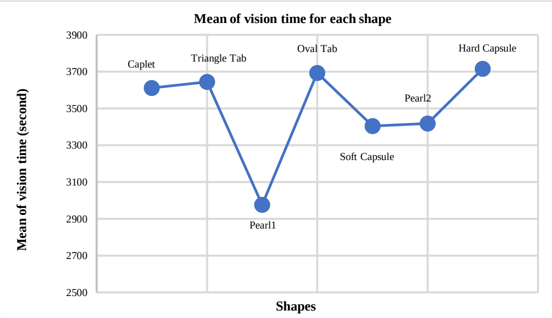

Figure 3: Mean of vision time for each shape.

ANOVA clarified that there was no statistically significant difference between different shape groups in terms of mean vision time (**Table 4**).

Although there was a difference in the mean vision time, no significant difference has been demonstrated among different shape groups (**Figure 4**). In addition, no significant difference between men and women groups was observed.

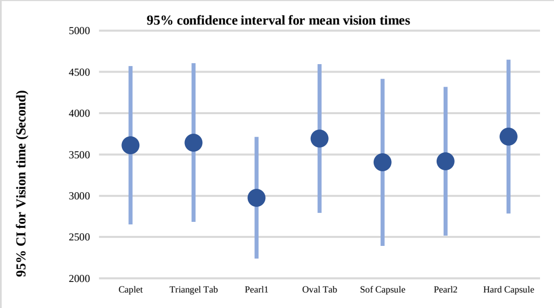

Figure 4: 95% confidence interval of mean vision times for each shape.

Table 3: Descriptive analysis of vision time for each shape.

Shape	N	Mean	SD	95% Confidence Interval	Min	Max
Caplet	26	3612	2373	2653 - 4570	464	7603
Triangle Tab	29	3645	2531	2682 - 4607	68	9390
Pearl 1	29	2976	1938	2239 - 3713	134	6920
Oval Tab	28	3693	2323	2792 - 4593	67	8702
Soft Capsule	30	3404	2710	2392 - 4416	67	10287
Pearl 2	28	3418	2322	2517 - 4319	66	8059
Hard Capsule	29	3716	2452	2783 - 4649	66	7849
Total	199	3492	2367	3161 - 3823	66	10287

Table 4: ANOVA test for the difference in vision time among different shape groups.

Groups	Sum of Squares	df	Mean Square	F	Sig.
Between	11735225	6	1955871	.342	.914
Within	1097956661	192	5718524	--	--
Total	1109691886	198	--	--	--

3.3. Colors

Previous studies addressed the subject of which design attributes (e.g. proto typicality, unity) influence consumers' cognitive and affective responses [34]. Specific studies on color and shape are rare, especially practical research. The purpose of this study was to provide a way to find the right color and shape for dietary supplements in the pharmaceutical industry.

The results indicated that color affects preferences. Moreover, differences in preferences for colored products by both genders were noted previously [35]. Some earlier investigations showed that consumers have certain preferences for color in or all solid forms [5, 36]. If the color of the drug was not by its perceived effect, consumers may not comply successfully with their prescribed treatment [6]. Therefore, color preference is more important for both clinical and marketing aspects.

A gender effect also appears in our results. Women appear to distrust medicines more than men. Previous studies showed that gender has a meaningful relationship with preferences regarding color and shape [37].

In this study, it was shown that consumers of general health supplements prefer to use white color. Earlier studies demonstrated that in the adult age group, white color is the preferable color for oral solid forms such as tablets.

The results also demonstrated that the most undesirable color was pink [5]. It is proven that flavor perceptions can be induced by the color of tablets [38]. The color of oral solid forms has been correlated to taste, yellow color is related/belongs to salty, and pink is correlated to the sweet taste of the tablet regardless of its actual components [39]. Several studies have been conducted to investigate the effect of color on perceptions of efficacy [36]. Studies showed that blue is usually considered relaxing or tranquilizing while yellow and red are characterized as stimulating or exciting [40]. For capsule dosage forms, it was shown that red and black capsules referred to more potent than blue ones [6]. The color of a tablet has also been associated with specific diseases and can affect patient adherence. A change in tablet color can reduce adherence in patients who take medication for seizures [41].

3.4. Shapes

Acceptability is the general ability of the patient to practice a pharmaceutical product as intended [42]. The swallowing process can affect the acceptability of oral solid dosage forms of medications such as tablets or capsules [43].

On the other hand, visual aspects of supplements such as color or shape can be helpful to recognize and differentiate supplements, furthermore, from aesthetic considerations, it's important to accept each product consumer [37].

Acceptability of patients for tablets and their compliance is beside the factors described by other studies, related to the visual appearance of the tablet [14]. Hence, the status of size has been investigated and big capsules were thought to be more potent than small capsules. however, for tablets, the perfect size would be small, circular, and coated [5].

Other studies showed that gelatin capsules were easier to swallow than tablets and coated tablets were easier than uncoated tablets [11]. The probable color was white for both tablets and capsules. The preferred shape for small tablets was arched circular, and oval for medium and big size tablets. The difficulty to swallow of the tablets is increasing with bigger sizes [11].

However, we could not find any meaningful results to show any difference between various shapes, it is obvious that consumers prefer to use smaller sizes.

4. Conclusion

This study aimed to investigate what colors or shapes for solid dosage forms are most preferable by consumers. The results indicated that white color is the most favored color and pink color was the least favored one. In addition, the hard capsule was selected as the most favored dosage form while the pearl 1 was selected as the least favored one. No significant difference between men and women groups was observed.

The results of this study were demonstrated considering the association between gazing behavior, cognitive aims, and defined tasks. This study showed the status of understanding factors influencing eye movements in an eye-tracking test for a better achievement of this method.

This may be important for pharmaceuticals to produce medicines with the most preferences for both clinical and marketing aspects. Color is the most preferred characteristic for solid dosage forms by consumers with the perception that color is related to the therapeutic indication of supplements. Shape and size can affect preferences regarding the compliance of patients. The pharmaceutical industry is increasingly recognizing the needs of individuals who experience difficulties taking conventional tablets and is responding with products that are easier to swallow and more convenient to take. Based on The results of this research, in brief, the perfect form of general supplements is small and white in color.

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Conflict of interest

The authors declare to have no conflict of interest.

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