

REVIEW ARTICLE

The impact of color on food choice

Vitória Ribeiro Garcia de Figueiredo Muniz^{1*} , Isabela Sampaio Ribeiro¹ ,
Karolline Ribeiro Lima Beckmam¹ , Rossana Catie Bueno de Godoy² 

¹Universidade Federal do Paraná, Departamento de Engenharia Química, Programa de Pós-Graduação em Engenharia de Alimentos, Curitiba/PR - Brasil

²Embrapa Florestas, Colombo/PR - Brasil

*Corresponding Author: Vitória Ribeiro Garcia de Figueiredo Muniz, Universidade Federal do Paraná, Departamento de Engenharia Química, Av. Francisco Heráclito dos Santos, 100, CEP: 80060-000, Curitiba/PR – Brasil, e-mail: vic_figueiredo@hotmail.com

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Abstract

In addition to preserving the goods, packaging captures potential buyers' attention, provides information about product benefits, changes consumer beliefs, and increases the chances of a sale. Thus, this review aimed to provide information on the impact of color perception on food packaging by consumers. Using color on packaging results in product differentiation, increasing the advantage over others and building sales loyalty and emotional connections. Besides the product color, the colors of its packaging can play an essential role in the perception of product taste, as people tend to create associations of specific colors with specific products and associations with particular tastes.

Keywords: Coloring; Purchase decision; Food packaging; Purchase profile; Attractive packaging; Sensory analysis.

Highlights

- The colors on packaging significantly influence consumers' choice of food
- Each type of color associated with a product has a unique meaning
- Consumers have come to add value to more product information on the packaging

1 Introduction

Product purchase decisions are mostly made directly at the point of sale, and while visiting supermarket shelves, the consumer goes through several brands until one of them has a greater power of persuasion. Product packaging is responsible for generating a perception of the product. Therefore, product packaging is an extremely important fact in the choice decision, thus presenting the ability to capture the attention of potential buyers and increasing the probability of sale (POPAI, 2012; Spence & Velasco, 2019; Hallez et al., 2023)

The consumer's evaluation of a product is based not only on intrinsic factors but also on extrinsic factors of the product, e.g., packaging, labels, shape, and color (Hallez et al., 2023). Thus, in addition to the ability to protect food from light, humidity, oxygen, heat, and microorganisms, among others, the packaging is a



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communication tool with the consumer, with the objective of intensifying emotions, attracting attention, expressing the identity of the brand, inducing desire and appetite (Spence & Velasco, 2019). Therefore, consumer research, identifying the profile and associated factors during the purchase, is widely addressed in sensory marketing. Packaging, when assertive, can be used to inform the benefits of the product, change consumer beliefs and encourage their purchase.

It is known that several sensory conditions are present and can influence the shopping experience. The attributes contained in food packaging can raise consumer expectations regarding flavor, color, and texture, among others (Gilbert et al., 2016). According to Spence & Velasco (2019), the color of the package provides human emotion, a sensation of movement, and an evolving and compulsive dynamic, acting directly on the optical, physiological, and neurological functions of the consumer.

According to Spence & Velasco (2018), packaging color can be analyzed in terms of three distinct components: hue, brightness, and saturation. Hue refers to the broad category of colors (such as red, yellow, black, etc.), saturation relates to the intensity of the hue, and brightness refers to the amount of black/white added to the hue.

Product color can play an important role in the perception of product taste, as people tend to associate specific colors with particular tastes (Zellner et al., 2018). For example, red colors are often associated with sweetness, while green colors are associated with acidity (Koch & Koch, 2003). Thus, the perception of food and beverage colors influences the way we perceive products and, consequently, their choice.

In addition to the color of the product itself, the colors of the packaging, the dishware, or even the environment influence the expectations and perception of the food (Spence & Velasco, 2018). This occurs due to an immediate reaction of the brain in associating that moment with previous experiences, and this attempt to anticipate the characteristics of the food generates expectations about it, expectations that affect the behavioral response and sensory perception (Piqueras-Fiszman & Spence, 2015; Schulte-Holierhoek et al., 2017).

Each color has a different connotative meaning in people, and the use of colors associated with lighting and saturation can arouse sensations and define actions and behaviors; for example, warm colors (red, yellow, orange) can be used to assign sensations of closeness, warmth, density, dryness, besides being stimulants. At the same time, cool colors (blue and green) can provide the sensation of distance, lightness, and calm (Crepaldi, 2006).

Crepaldi (2006) demonstrated that 81% of consumers said that the colors used on packaging always or occasionally draw their attention. A similar result was found by Carneiro et al. (2010), who reported that 75% of the participants in their research observed the color of the label.

The use of color is a strategy to make consumer choice even more efficient if combined with other attributes present on the packaging. According to Laimona & Iliona (2014), the use of color on packaging results in product differentiation, increases the advantage over others, builds sales loyalty, and builds emotional connections. In order to achieve this, it is essential to use a color that is associated with the product and relates to the target audience (Gonçalves et al., 2008).

In addition, the influence of thermal sensations and color luminosity on consumer behavior is also observed. Motoki et al. (2019) demonstrated in their study that when consumers are under a comfortably warm temperature condition, there is an improvement in the direct visual perception of light-colored products, as well as an increase in the preference for light-colored products. Thus, consumers who were in a comfortably warm room were more willing to purchase light-colored consumer goods, proving the importance of package color in the purchase decision.

Aware of the need to study the attributes contained in food packaging, this review article aimed to present evidence from several studies that address the use of colors or not, to discuss the influence or not on consumers' food choices when exposed to these products.

2 Methodology

This review is a bibliographic study, gathering research with emphasis on the theme presented. Thus, work already done has been presented that shows the importance of color in food regarding the attractiveness provided to the consumer.

It started by determining important colors in foods, and later foods that are impacted by the differentiation of colors presented on their packaging or label. The search criteria used were articles with titles and abstracts that were of great interest and that were closest to the intended objective. The keywords used in the search were: influence, packaging, coloring, food packaging, attractiveness, and consumer acceptance. Papers published between 1997 and 2023 were used, but preference was always given to more recent reviews. In the end, 62 articles were selected that presented studies with better results close to the expected goal (Figure 1).

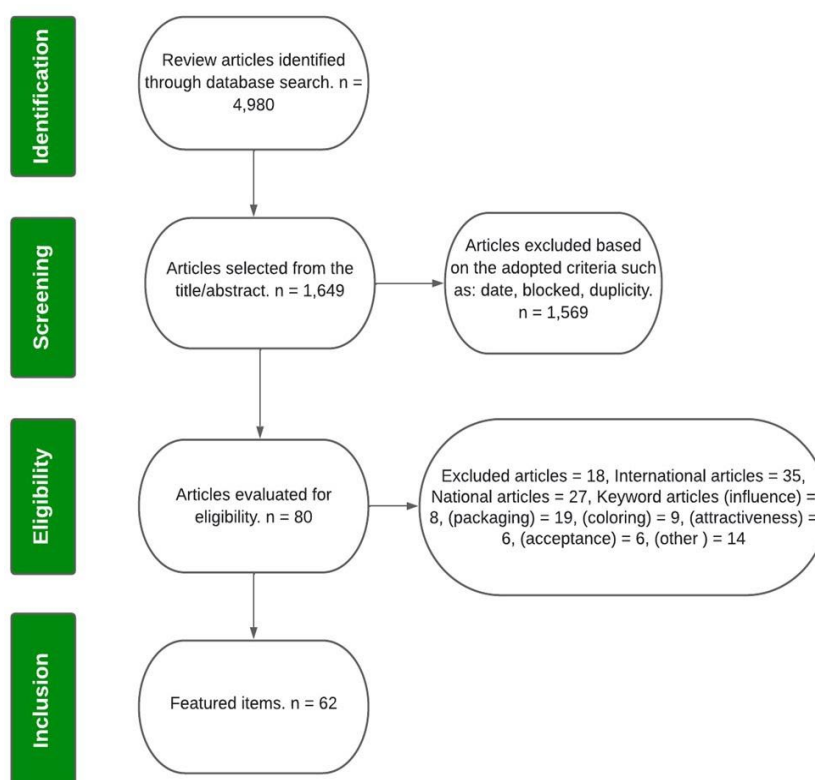


Figure 1. Flowchart of selected articles.

2.1 Colors used on food packaging

2.1.1 Red color

When speaking of red coloring, one immediately thinks of ready-to-eat foods that have this color, such as fruits, and in the same way, the good taste and flavor of these products are projected. In addition, this color is associated with positive feelings such as love and happiness.

In a study using a solution that would suggest a juice in red color obtained, it was found that in a given country, the solution was associated with cherry, while in another country, it was associated with the taste of watermelon. This difference may be related to the culture of each country in terms of greater contact with each fruit. Colors such as red, orange, and pink may be attributed to a sweet taste, so they can be used in products with a tendency to have a bitter taste, reducing this perception (Martins, 2017). In addition, a study with Canadian children showed that packages with red colors convey the feeling of healthy and tasty food

(Angka et al., 2020). Therefore, the red color has great potential for being used in food packaging that needs to be remembered as sweet and also when the intention is to highlight the healthiness of the product.

2.1.2 Blue color

Few natural foods have blue coloring, yet this tone is often found on packaging. Pereira (2014), when investigating the symbolic function of blue on food packaging, found that this color is the second most recurrent, while none of the analyzed foods have blue in their colors. The study also showed that the tone, a cool color, opposite to warm colors, widely used in food, indicates moderation, rationality, and austerity. The blue color's role was to indicate characteristics related to healthy eating, reduction of ingredients, or even to highlight premium products from the others, themes highly publicized nowadays.

Another research identified blue as the second most predominant color in dairy product packaging due to the fact that the color conveys tranquility, reliability, and hygiene (Guilhon et al., 2021). Therefore, the blue color should be used when the intention is to convey to the consumer the idea that it is a product with high added value, either because of its rigorous quality control, because it is a product with a healthy appeal, or even because it is a food that stands out from others of the same class.

2.1.3 No color

The lack of color or the transparency of packaging materials has been heavily studied since this absence of color draws attention to the colors of the product itself. Fresh food and beverages are produced, transported, and sold in transparent packaging to expose the natural color of the food and promote an attractive impact on consumers. Consumers typically tend to select fresh produce according to its maturity or fresh appearance (Howell & Schifferstein, 2019).

In the retail market (retail stores, food services, or supermarkets), fresh foods are sold in trays, crates, or shelves and are often plastic wrapped to be viewed (Landim et al., 2016). According to Billeter et al. (2012), transparent packaging conveys confidence to consumers, directly influencing their purchase decision. Among foods with transparent packaging, rice, beans, pasta, sugar, oil, and minimally processed fruits and vegetables can be mentioned. As seen in the cited studies, the transparency of the packaging allows consumers to view the products, thus verifying whether or not they present the expected level of quality and then deciding on the purchase (Silva Filho, 2010).

2.1.4 White color

Despite being widely known as the white color, white is actually a maximum brightness and not necessarily a specific color. However, this shade is widely used in food packaging. According to Stamato et al. (2013), in general terms, white represents peace, purity, and lightness. A study carried out with commercial brands of oats, chamomile tea, and whole grape juice suggests that the packaging of these foods is predominantly white, as this tone suggests well-being, sophistication, and taste, characteristics related to such foods (Calegari et al., 2016).

Guilhon et al. (2021), when studying the predominant colors in the packaging of milk and derivatives, found that white is the most predominant color in all products, mainly because this color refers to the product's raw material, liquid, and pure milk. In addition, the color refers to peace, calm, purity, hygiene, and cleanliness. Given the above, the white color is very useful when the product is related to tranquility, such as tea, or even when the product must undergo strict quality controls, such as products of animal origin.

2.1.5 Black color

The color black is a visual sensation that does not have the attributes of hue and saturation but only the absence of clarity (Pereira, 2017). Black, purple, brown, and darker colors are associated with a bitter taste (Martins, 2017). The color black in the beverage segment uses packaging in this color for alcoholic beverages to indicate a higher alcohol content. In contrast, for non-alcoholic beverages, it is related to lower amounts of sugar like soft drinks. Another way to use black in packaging is to indicate more organic or sophisticated foods (Howell & Schifferstein, 2019). Pereira (2017) stated that black evokes austerity, seriousness, and sophistication. Therefore, its use in special or premium products is recommended since this color gives the consumer the feeling that the product has better quality than others.

2.2 Impact of packaging color on food choice

2.2.1 Dairy products

When it comes to milk and its derivatives, a survey found that the predominance of white and blue in their respective packaging suggests purity, quality, and confidence in the product being marketed to the consumer. The same study also found that some brands of liquid milk, despite having white on their packaging, also contained brighter colors, such as red and yellow. The main reason for applying these colors to containers is that brands seek to differentiate themselves from others. Both red and yellow are attractive and vibrant tones, which, if used in balance with white and light colors, draw the consumer's attention, increasing the chance of purchase (Guilhon et al., 2021). According to Botelho et al. (2015), the colors on milk packages, in addition to communicating with consumers' different meanings, also represent the emotional relationship between them and the brand, thus being an essential factor at the time of purchase.

Despite being presented as a single food, liquid milk is a grouping of several types of products, mainly skimmed, semi-skimmed, whole, and lactose-free milk. When analyzing these types of foods, Pereira & Linhares (2014) found that each brand has its coloring system; that is, a specific brand uses one color for whole milk, another for semi-skimmed milk, another for skimmed milk and another for lactose-free milk. However, another brand uses different colors than the first to differentiate the four products. As a result, the research identified that the predominant colors in whole milk packages are red, pink, and violet-blue; yellowish green, light green, and red for semi-skimmed milk packages; blue and yellowish green for skimmed milk packages; and finally, orange, and dark orange for lactose-free milk packaging. Consumers need help using this information system as differentiation is not universal, having to resort to the writing on the packaging to confirm that it is indeed the product they want to take home.

2.2.2 Restricted foods

The association of healthy product packaging colors depends on the product category; for example, for crispy bread, using light brown on the packaging results in healthier product expectations, whereas bright yellow was associated with the product being less healthy (Spence & Velasco, 2018).

In their studies, Mead & Richerson (2018) reported that consumers perceived a nutritional bar as less healthy when presented in bright packaging and with greater color saturation than when presented in silenced packaging with lower color saturation.

Tijssen et al. (2017) investigated the effects of packaging color on the perception of healthiness and attractiveness, both in sugar-reduced and fat-reduced products, and found that using less vibrant and watery colors is more strongly associated with 'healthiness' rather than 'attractiveness.' While for intense colors, there is a perception of attractiveness. In this way, the researcher suggested using warmer-colored packaging, similar to the packaging of the regular product, in order to provide more attraction to the healthy product.

2.2.3 Coffee

Regarding coffee, in addition to price and brand, color is an essential factor in the purchase decision. Sant'Anna (2020) analyzed the influence of colors in coffee packaging on consumer perception and response and found that the black and green colors stood out. The black color is more similar to the product itself, while the second one refers to something more natural and organic, a concern that has been growing lately. Among the non-conventional colors tested, the white color showed greater acceptance by the public because it provided packaging associations with sensory characteristics of flavor and positive attitudes and thinking. Thus, confirming the importance of the association people make when looking at these colors on coffee packaging.

Corso & Benassi (2015) observed an increase in the purchase intention of instant coffee when it was in more modern packaging and browner labels that indicated roasted coffee. Participants even suggested using a brown cap and label, but with a small quantity of green to show the inclusion of green coffee. Furthermore, they valued more information on the back label related to product differentiation since they were willing to pay more for a differentiated product if they were well-informed about the benefits.

Della Lucia et al. (2007) evaluated the purchase intention of organic coffee to the packaging. They identified that although the color of the packaging is vital for the consumer, in this study, the color had little impact on the evaluation, unlike the additional information about organic, which positively affected the purchase intention of 79% of the participants, which demonstrates the behavioral changes of consumers who increasingly seek and like to find information about the product described on the packaging.

2.2.4 Chocolate

Chocolate is a very popular food among people of all ages and classes, and it is divided into two kinds: milk chocolate and white chocolate. When cocoa is added to milk chocolate beyond the legislated proportion, it can be considered bitter or semi-sweet depending on the minimum percentage of added cocoa, becoming a food with less sugar content and containing health benefits (Martins, 2017).

However, due to the increase in cocoa content in the formulation, it becomes more bitter, as well as reducing consumption among people with more sensitivity to this taste. (Martins, 2017) Thus, studies carried out to evaluate the effect of the color of the packaging on the perception of the different tastes of chocolate when sweet and bitter determined that the colors red, silver, and black influenced the acceptance of chocolates with bitter and sweet taste content.

Red and gold on chocolate packaging are related to communication, approximation, and formulation of meanings, and they are responsible for impacting and qualifying the product in terms of its appearance (Schulz & Guedes, 2014). Black on chocolate packaging is associated with the percentage of existing cocoa, which indicates a bitter taste in the product (Schneider et al., 2018).

2.2.5 Beer

Beer is an ancient food and one of the world's most consumed beverages, and it is widely found in retail stores and is classified as regular or craft beer. Standard beers are those produced on a large industrial scale, which use, in addition to malt and barley, other types of cereals such as corn and rice in their formation. For these beers, it is observed that the colors gold and yellow are predominant on the labels, which consumers associate with the natural colors of a quality product. This study also found that most beer packaging does not allow viewing the product, so consumers associate the images and texts in gold and yellow with the actual color of the food. With beer packaged in green bottles, consumers associated this product with greater bitterness, even without tasting the drink. This is because Heineken beer, widely sold in green bottles, has a more bitter taste (Serradourada, 2018).

Craft beer is defined as beer produced on a smaller scale, with traditional ingredients, such as malt, hops, and barley, and may also be composed of wheat. In recent years there has been a significant increase in the consumption of craft beer, which is associated with better quality and sophistication. According to Farneda (2011), using warm colors, such as red, yellow, and gold helps beers increase their visibility to the consumer. However, because they are intense colors, they should be used cautiously and in balance with weaker colors to avoid fatiguing the consumer. Still, according to the author, cold colors, such as blue and black, when highlighted on the packaging of this type of product, do not draw attention and should therefore be avoided.

A study by Ribeiro et al. (2020) investigated the perception of consumers and experts about craft beers of different colors, which were served in different containers. The data revealed that the color of craft beers influenced the expectations of consumers and experts, so craft beers with similar colors were associated with the same cup shapes by all participants. An essential point of this study is that wine glasses were related to red beers, which is justified by the fact that wines, mostly in red tones, are served in glasses. Rocha & Melo (2019), in a comparative study between the Colorado beer label and other craft beers found in supermarkets, observed that consumers associate the packaging colors with the brand mentioned above, making them one of the main characteristics observed by them at the time of purchase.

2.2.6 Wine

The evolution in the wine market has been gaining significance, where the offer of bottled wines has been growing both in quality and diversity, which triggers competitiveness in the market. The quality and price of products are still fundamental attributes, but with innovations, emotional attributes are increasingly influencing consumers in product choice. Studies confirm that the decision to purchase wine is made at the time of purchase, giving significant importance to the product label as they facilitate the continuity of the initial contact, extending the time of contact and exposure to the product (Torres, 2013).

The visual elements of a package include image layout, color, product photography, and product presentation. The characteristics of the packaging are responsible for transmitting messages to consumers, where their contact with the product is only visual and not taste-based. The packaging and the label convey emotion and aesthetics, and they are the two attributes responsible for choosing a good wine by inexperienced consumers. The label presents relevant information and draws attention with its light and neutral colors, while the bottle has a designer and coloring. The color of the bottle is of great importance in exposing the product's color because before opening the bottle, the only idea of color is perceived by the consumer and passed through the bottle. Combinations of attributes such as color, images, drawings, symbols, and shapes are quickly recorded and attract consumers' attention, thus facilitating the identification of the wine on display (Jesus, 2021).

2.2.7 Vegetables

When we talk about vegetables, we know that they are products with a higher requirement in terms of packaging specifications because, unlike foods such as meat, pasta, cheese, and others, after being wrapped, foods like fruits and vegetables continue the breathing process. Packaging is responsible for slowing down this metabolism. Thus, the produce can delay its deterioration, maintaining characteristics such as color, flavor, and aroma (Embrapa, 2011).

The control of the physiological activity of plants is the principle for the conservation of the product, so it is of great importance that physical, chemical, biochemical, and environmental parameters must be adjusted to determine its packaging (Sarantópoulos, 1997). The size, shape, material, permeability, integrity of the closure and transparency of the package must be determined. The non-color of the package is a characteristic of great importance at the time of the commercialization of vegetables because it is through visual contact that the color and appearance of the product are emphasized, making sure the consumer determines whether the food is suitable for consumption and if it meets their requirements (Embrapa, 2011).

The products have an expected color and appearance, characteristic of each vegetable. We know that the tomato is more used when it is in a state of ripeness, where it is found in red and the banana in yellow. These are the visual characteristics of each product. It is associated with reactions of rejection, indifference, or acceptance. If the consumer expects a specific color in a vegetable and if it differs from the expected shade or intensity, the product will not be well accepted (Segalla et al., 2015).

In addition to acceptability, the market becomes more demanding due to the consumer's perception of choosing the product. Studies have identified socioeconomic extracts that determine purchasing fruits and vegetables, such as nutritional value, quality, flavor, aroma, texture, and appearance. Consumers rely on looks to determine whether it will taste good at appearance. Some colors convey freshness, acidity, and flavor in vegetables (Onoyama et al., 2010).

2.3 Animal-based protein and plant-based protein

Animal products are commonly packaged in transparent plastic that allows viewing, directly interfering with the purchase decision (Billeter et al., 2012; Landim et al., 2016). In this sense, packages that help prevent color change and the oxidation process in meat are advantageous (Djordjević et al., 2018). Several studies show that vacuum packaging prolongs the shelf life of products of animal origin, as the removal of oxygen helps to prevent oxidation and deterioration of the meat and consequently, the change in color of the product (Devatkal et al., 2014; Brenesselová et al., 2015) which conveys greater confidence to the consumer.

However, it is already known that the excessive consumption of meat products can cause several health problems, including non-communicable chronic diseases. In addition, the production of various types of meat damages the environment. Therefore, the tendency to replace such products with nutritionally similar ones from different origins has been gaining strength (Pater et al., 2022). Among foods that can replace meat, vegetable proteins are the ones that most resemble them (Sánchez, 2022).

Sucapane et al. (2021) explored consumer perceptions of color combinations and descriptors of alternative plant-based products. They demonstrated that using a “meat alternative” description with a green packaging color negatively impacted perceptions of being eco-friendly. Using a “plant-based” description with a green packaging color negatively impacted predicted satiety. This study highlights the importance of consumers' perceptions of the product and reflects on their behavioral intentions.

In a study conducted with Dutch children aged eight to ten years on general perceptions of plant-based substitutes for meat products, children prefer products to be packaged in packaging similar to that used for meat. That is, they prefer the packaging to be transparent or to have some transparent part that allows the product to be seen, and where the distinction between meat and plant-based products is made through the text. Regarding colors, white packaging was described as “boring,” while packaging with green tones was associated with nature, and the environment, indicating the perception that these products are environmentally friendly (Pater et al., 2022).

2.4 Children's products

We cannot fail to mention that children's preferences are very relevant for marketing products aimed at children. Angka et al. (2020) noted that children could associate a food product with certain colors according to what they have learned, their culture, or the color of the product itself.

Brunk & Moller (2019) observed that children under ten prefer to have their food packaged in colored material rather than in black and white packaging. Similar results were found by Mzoughi et al. (2017), where children under ten claim to prefer vivid and bright colors.

Macalister & Ethridge (2019) conducted a study with preschool and elementary school children in Virginia using cards with pictures of food and snacks in different colors. They reported that the colors associated with

gender could affect younger children (3-6 years), and the pink preferences for girls and blue for boys were observed in the card choices.

Angka et al. (2020) conducted a study with children serving cucumbers on plates of different colors and observed that the packages' colors and claims do not directly affect their choices. However, the choice of packaging is directly related to the color preferences of each child, which represents a challenge for the industry to identify the ideal colors for the packaging.

2.5 Use of color in smart packaging

There is a growing demand for easily accessible, high-quality foods, and food packaging is aimed at protecting the integrity of the food, and it is becoming increasingly important. Among the diversity of packages, there are also intelligent packages, which can communicate and inform some characteristics of the food content from the change of colors (Asdagh et al., 2020).

Smart packaging helps monitor food quality and can indicate product maturation, deterioration, temperature status, or condition of the packaging itself. This is done using detectors in the packaging that react chemically or enzymatically when they are in inadequate conditions, causing an irreversible change, such as, for example, changing the color of the packaging. Thus, these packages inform the producer, retailer, and consumer of food quality during food transport and storage (Realini & Marcos, 2014, Chavoshizadeh et al., 2020). There are intelligent packages that undergo a color change in response to exposure to heat to avoid exposing food to inappropriate temperatures during transport and storage, which can directly affect the quality of the product. Time-temperature indicators are especially valuable for cold and frozen foods, significantly impacting the quality and safety of these products. According to Barska & Wyrwa (2015), it is possible to provide information about the product's shelf life, being very useful, for example, for sauces stored in the refrigerator. Microbial quality can also be determined by the color change in response to microbial growth metabolites produced during spoilage (Brizio & Prentice, 2015). It is still possible to indicate the presence of pathogenic microorganisms from a poison identifier (Mirza Alizadeh et al., 2020).

From the gas composition in the package, the package itself can indicate if there is a leak or if it is properly packaged. That is if a sealed package contains a lot of oxygen, a change in the package's color occurs, indicating a leak, which in turn may compromise the quality of the product. This color change of O₂ and CO₂ indicators results from enzymatic or chemical reactions (Jang & Won, 2014). In this way, this color change on the packaging allows for interaction with the consumer, providing a greater understanding of the quality of the product.

3 Conclusion

Given the observed aspects, it can be concluded that the color or non-color on packaging greatly influences food choices and may affect consumers' emotions and their expectations concerning the product. In addition, consumers have shown a behavioral change, where they are increasingly interested in the information on the packaging, which emphasizes the need for well-analyzed packaging to meet the needs of each target audience. Therefore, the use of colors and information in an appropriate way allows consumers to have positive feelings that will influence their decision to purchase the product, generating emotional connection and trust.

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