

Plating for Perfection: An Exploration of Techniques for Optimal Food Decorating Strategies and Aesthetic Visual Appeal in Indian Cuisine

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ABSTRACT

The appearance of a dish is just as important as its taste. While it may seem unimportant, the art of decorating food in an enticing way requires skill and expertise. Over the past decade, research on food decoration and its impact on eating behaviour has significantly increased. Specifically, studies have examined how different sensory cues such as smell, taste, touch, sound, sight, and trigeminal sensations contribute to our perception of flavour when presented with various food and beverage options. Here this systemic review focuses on the latest evidence highlights the importance of contextual factors in food decoration and how they influence people's behavioural and pleasurable responses to different food and drink items. Recent studies have emphasized the significance of factors such as color, shape, texture of food and plate ware, balance of elements on a plate, as well as environmental cues in determining what, how much, and how quickly individuals consume food and drinks, and even how much they enjoy the experience. Additionally, the role of tableware in eating, drinking, and flavour perception, and how a size-contrast illusion unknowingly leads consumers to serve and consume more food when using larger dinner plates and serving spoons,

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has been highlighted. These findings support the notion that people "eat first with their eyes" and that the visual presentation of a dish can greatly enhance or diminish a diner's experience of the same ingredients. The aim of this study is to investigate how food decoration influences the intricate details of eating behavior and subjective motivation to eat. In conclusion, the visual presentation of food has a significant impact on various aspects of food perception, including satisfaction and eating behavior.

Keywords: Food decoration; food impressions; chefs; taste; side dish; eating behaviour.

1. INTRODUCTION

"The first taste is always with the eyes."

Food should be presented in an artistic manner, playing with colors and shapes, and the arrangement on the plate should resemble a work of art, akin to a sculpture or a painting.

In the 1700s, both Asia and Western Europe's affluent classes admired chefs who prepared and served visually stunning dishes. This increasing variety and originality in multisensory food presentations and plateware not only represents a new phase in the aestheticization of our food experiences but also emphasizes the growing importance of visual elements in dining experiences and the blurring of boundaries between what is edible and non-edible, contributing to the varying degrees of success in these endeavors.

Food decoration techniques vary depending on the dish being prepared, which can be divided into four parts: the main dish, side dish, sauces, and garnish.–

Main Dish: The main dish is typically the heartiest and most substantial, often consisting of meat, fish, or another protein source. **Garnish :** Garnishes are decorative elements accompanying a prepared food dish, such as herbs, chopped raw onion, tomato, edible flowers, and more.

When plating food, it's vital to balance substance, textures, flavors, and colors to avoid chaos. Start from the plate's center, avoid overcrowding, and maintain proportion. Visual flow matters, so consider the lower left to upper right scan. Leave a buffer zone around the rim. Complementary colors enhance the appeal. Layering and height add visual interest. Create patterns by repeating lines and soften angular edges with arcs and swirls for fluidity.

One traditional technique for plating is the clock method, where the plate is divided into zones resembling a clock from the customer's perspective –

- Main dish is typically placed between 3 and 9 o'clock,
- Starches between 9 and 11 o'clock, and
- Vegetables between 11 and 3 o'clock.

Sauces can be used to add visual interest to a dish. For instance, a small, ethnic restaurant would typically have a simple and rustic food presentation, while a high-end restaurant would focus on delicacy and elegance in its dish presentation. Garnishing should be simple and clean, using edible ingredients already present in the dish.

2. PLATING TOOLS FOR DECORATING

Choosing the right plate for food presentation is important, with considerations such as material, size, and color. Plate size depends on the restaurant's style and can influence portion perception. Complementary plate colors enhance the visual appeal of specific foods, and different plate materials offer a range of options for various occasions.

3. REVIEW OF LITERATURE

Food decoration involves modifying, processing, arranging, or adorning food to enhance its visual appeal. Plating has evolved into a crucial component of the dining experience, influencing culinary creation and how dishes are received.

It's important to recognize that the way food is presented can impact the three main elements of pleasure identified by Daniel Kahneman in his study of hedonic psychology: the enjoyment of anticipation, the actual experience, and the memory afterwards [1].

Factors like the shape and size of plates, the surrounding lighting and arrangement, colors, and convenience play a role in influencing a person's eating experience.

3.1 Vision and Eating Behaviour

In the study titled "A Review of Visual Cues Associated with Food on Food Acceptance and Consumption" by Devina Wadhera and Elizabeth D. Capaldi-Phillips [2] it was discovered that various sensory cues play a role in food intake, including appearance, taste, odor, texture, temperature, and flavor. While taste is an important factor in regulating food intake, the initial contact with food is often made through visual perception. However, there has been limited research on how the visual appearance of a food portion affects its acceptance and consumption. Therefore, the purpose of this review is to explore the different visual factors associated with food, such as proximity, visibility, color, variety, portion size, shape, number, and surface area, and to examine their impact on food acceptance and consumption. The review suggests that visual cues can be utilized to increase fruit and vegetable intake in children and reduce excessive food intake in adults. Furthermore, it emphasizes the need for future studies to investigate the relationship between unexplored visual dimensions of food, specifically shape, number, size, and surface area, and food intake [3].

The visual system plays a crucial role in food selection. Numerous functional neuroimaging studies have been conducted to examine brain responses to visual food stimuli. However, these studies have produced diverse results, and there is still uncertainty regarding the specific brain regions involved in the neural processing of viewing food pictures. The objectives of this study were to determine the common brain regions activated when viewing food pictures and to assess how hunger state and the energy content of the food modulate these effects [4].

The order in which food samples are presented and the samples that precede them can influence the perception of sensory attributes. In conventional testing procedures, these effects are typically addressed through the use of appropriate experimental designs for assessing order and by averaging responses across multiple assessors [5].

4. DECORATION INFLUENCE EATING BEHAVIOR

The impact of decoration on eating behavior is a noteworthy phenomenon. The way in which food is presented holds immense significance as people often consume their meals visually first. Achieving a harmonious blend of colors, textures, and flavors is crucial when it comes to food presentation.

Elevating food presentation to the level of artistry, it encompasses not only the meticulous arrangement of food and garnishes on the plate but also the vessels used. This underscores the pivotal role of the person responsible for plating, as they contribute significantly to the holistic multisensory dining experience [6]. Food presentation extends beyond mere aesthetics; Furthermore, the seamless fusion of food presentation with the ambiance of the dining environment creates an optimal backdrop for diners to relish their culinary experiences to the maximum [7]. Consequently, the visual aspect of food presentation inevitably influences eaters' anticipation of taste and aroma quality, as well as their overall hedonic value [8].

Research indicates that the artful presentation of food carries considerable sway over customers' perceptions during their dining endeavors. Furthermore, these perceptions can be amplified by manipulating the surrounding colors within which the food is presented. This goes beyond just ambient lighting; it encompasses choices like tablecloths, tableware, and the arrangement itself. The study conducted by Piqueras et al. [9] substantiates this notion. In a captivating twist, consumers reliably associate a range of tastes, textures, and flavors with abstract shapes of varying angularity.

In essence, the meticulous decoration of food plays a profound role in shaping how we approach and experience our meals, underscoring the intricate interplay between visual cues and our sensory perceptions.

5. PLATE IN FOOD DECORATION

Selecting the appropriate plate format tailored to a particular dish holds significant significance. The choice of plate significantly influences how consumers perceive the dish, particularly concerning visually assessed attributes (such as their liking of the dish's presentation, the visual

appeal of the dessert, and the intensity of its color).

6. THE COLOUR OF THE PLATE

The Significance color of a plate holds immense importance as an intrinsic sensory cue for shaping people's expectations about the taste and flavor of food and beverages. The white dishes holding the actual food are placed on these colored charger plates.

While color preference is a crucial aspect of visual experience, the reasons behind people's inclination toward specific colors remain largely unexplored. The presentation of food on plates not only incorporates aesthetic appeal but also encompasses the artful arrangement of colors and ingredients, influencing how a dish is perceived upon consumption.

For instance, a dessert served on a round white plate might appear up to 10% sweeter than the same dessert presented on an equivalent black plate [10].

There have been intuitive and untested rules regarding the choice of colored plates. Similarly, the color brown is associated with overcooked or burnt food, which can suppress hunger. Some people may associate brown with homemade bread or baked goods, but in general, it is not a color that stimulates appetite. Many people are attracted to the color green and associate it with healthy eating [11]. A classic study investigating the influence of color on taste sensitivity examined the effects of coloring aqueous solutions red, green, or yellow on the ability to perceive four basic tastes (salty, sour, sweet, and bitter). Regarding sour taste sensitivity, both yellow and green coloring decreased participants' sensitivity, while red coloring had no effect [12]. Another study found that diners might assign higher value to foods presented on white (conventional) plates simply because white is the color most familiar to Western diners. This finding aligns with the concept that familiarity often leads to preference, as seen in the mere exposure effect [13].

7. THE RELATION BETWEEN COLOUR AND FLAVOUR OF THE PLATE

Studies have shown that altering the color of certain foods can affect recognition, and the mousse in one study may have appeared more noticeable on a white plate than on a black one.

Another study found that after eating chocolates of one color, the pleasantness of the taste declined more for that color compared to others, even if the chocolates only differed in appearance. Presenting a variety of chocolate colors didn't affect food intake compared to consuming one's favorite color [14,15].

Visual cues are found to influence odour judgements significantly and, when presented with conflicting stimuli, the visual cues appear to override the olfactory sense and distract the subjects from making the correct assessment. A study investigated the role of food colouring in the understanding of the depth of a particular taste (e.g., strawberry, banana, etc.) or taste attribute (e.g., sweetness, saltiness, etc.) and their role in the perception of flavour identity [16]. A study revealed how the colour of the bowl affects the taste of the food it contains. To answer this question they served popcorn in four different coloured bowls, and participants rated sweetness, saltiness, and overall liking. The sweet popcorn, in addition to being sweet, was perceived as saltier when eaten out of a coloured (as compared to a white) bowl, and vice versa for the salty popcorn. These results demonstrate that colour in bowl design can be used to elicit perceptions of sweetness and saltiness in real foods [17].

More recently, researchers tested the extent to which the colour of the plate ware (black and white plates were used) influenced the gustatory and hedonic experiences of a complex food (desserts with layers and decorations having different colours, textures, tastes and flavours). These studies have shown that people tend to associate specific colors with certain foods, and altering the colors of these foods can affect their recognition.

Another study examined how the sensory properties of food can lead to a decrease in the pleasantness of the tasted food. After consuming chocolates of different colors, the pleasantness of the taste of the consumed color declined more compared to the non-consumed colors, even though the chocolates only differed in appearance [19]. Visual cues, when conflicting with smells, significantly affect odor judgments and accuracy. In one study [20], food coloring's role in taste depth and flavor identity perception was explored. Additionally, the color of the serving bowl can impact taste perception, as seen with popcorn tasting saltier in colored bowls and sweeter in white bowls [21].

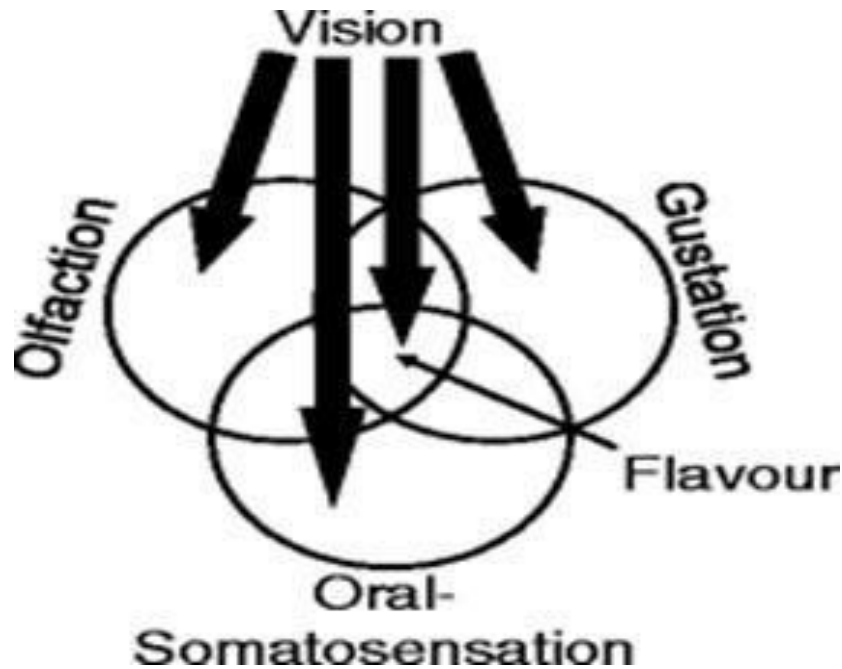


Fig. 1. Relation between vision and eating behaviour



Fig. 2. Desserts served on different coloured plates at the institut paul bocuse research centre in the study by Piqueras-Fiszman et al. [18]

A recent study showed that plate color (black and white) significantly influenced people's perception of complex desserts, with varying effects depending on the dessert type. Interestingly, each plate consistently affected specific attributes like appearance, color intensity, flavor intensity, and overall liking for each dessert. These results couldn't be solely attributed to contrast effects, as participants rated desserts differently based on plate color, even when they had similar hues. For instance, a darker brown dessert received higher ratings on a black plate, while other desserts were preferred on a white plate [22].

8. THE SIZE OF THE PLATE

Psychologists have found that plate size significantly influences eating behavior, affecting serving portions and consumption. In the last

century, plate size has increased by about 20%, mirroring the rise in average waist sizes.

In a study examining the effect of bowl size on food consumption during a social event, researchers discovered that participants given larger bowls served themselves over 50% more ice cream compared to those given smaller bowls. Furthermore, since the participants tended to finish their food, those eating from larger bowls ended up consuming a significantly greater amount of ice cream overall [23]. A different study conducted in a canteen used everyday bowls of different sizes to serve a pasta dish. The difference in capacity between the bowls was almost double, with one being 3.8 L and the other being 6.8 L. Despite everyone having the same sized individual plates, which were about 23 cm in diameter, participants who served themselves from the larger bowl ended

up with 77% more pasta and felt more full compared to those who served themselves from the smaller bowl [24]. A diminutive bowl might prompt individuals to remember that the food should be distributed among others. Consequently, they may wish to avoid appearing as if they are taking an excessive portion, which would leave less for others. There could also be a desire not to be the person who consumes most of the contents of a bowl or container, as this action might be viewed as self-centered behavior. On the other hand, when using a large serving bowl, it might create the perception that more food can be scooped out before any noticeable decrease in supply occurs. Additionally, it could convey the idea that there's a reduced risk of running out of food [25].

Wansink and his team explained the outcomes with the Ebbinghaus-Titchener size-contrast illusion and the Delboeuf illusion. In the former, a circle appears larger when enclosed by smaller circles. The latter illusion makes an identical circle appear smaller when encircled by a larger ring. They suggested these visual tricks influenced how much food seemed when placed in different-sized bowls, making it appear smaller in a larger bowl and larger in a smaller bowl [26].

The impact of plate size on eating habits shows some inconsistency. For instance, Rolls et al. found no significant correlation between plate diameter (17, 22, or 26 cm) and food consumed in three laboratory studies [27]. This difference in findings between controlled lab environments and real-life settings, as seen in Wansink et al.'s picnic study (2005), suggests variations in food consumption behaviour. The significance of portion size is related to people's health, such as in the 'French paradox,' where smaller portion sizes in France are linked to lower obesity rates and reduced heart disease risk despite higher saturated fat consumption compared to the US [28].

9. THE SHAPE OF THE PLATE

Plates vary in multiple aspects, not just color; they also come in diverse shapes. Some eateries utilize an assortment of eye-shaped, triangular, and rectangular plates, which they aim to coordinate with the presentation of the food. A relevant study discovered that individuals (including over 200 university students) perceived cheese as noticeably tangier (by approximately 10%) after gazing at jagged shapes, in contrast to gazing at rounded shapes [29].

Piqueras-Fiszman and colleagues explored if the plate's shape could impact how people perceive taste and flavor. Despite their efforts, they didn't discover any connection between the shape of the plate and the flavor of a strawberry mousse. The study included plates of square, round, and triangular shapes [30].

Typically, circular and white dishes have a tendency to amplify the perception of sweetness in dishes, while angular and black plates tend to emphasize more savory flavors. Additionally, presenting food on a red plate is often associated with decreasing the quantity that diners consume [31].

Yang suggests a tableware selection principle where round food pairs with square or elongated dishes. This raises questions about how food shapes affect diners' descriptions. Research suggests the 'Delboeuf illusion' may explain why larger dinnerware leads to larger servings and who is most affected. Understanding this illusion's impact on serving and intake based on dinnerware size could connect illusions with eating behavior and improve consumer well-being through simple design changes [32]

10. DINNERWARE SIZE AND THE DELBOEUF ILLUSION

In a different study, Researchers conducted three experiments to investigate the connection between cheese attributes and shapes. In the first experiment, participants at a Gastronomy event rated three aged farmhouse cheeses on a scale with rounded and angular shapes. They found significant differences in shape symbolism among the cheeses. In the subsequent experiments involving cheesemongers, cheese experts, and customers, participants assessed the attributes of different cheeses on an angular-rounded continuum, including smell, taste, and mouth-feel. The results suggested that the connections between senses were mainly influenced by taste rather than smell or texture. The study also explores the potential implications of these findings for marketing dairy products [33].

11. SHAPE OF FOOD

The perceived volume of food can be influenced by its shape. College students were tasked with deciding whether a square or circular pizza appeared larger. Over 70% of the participants believed the square pizza contained more than

the circular one. Likewise, the shape of individual food pieces can impact estimations of food quantity [34]. Sensory-specific satiety applies to the visual aspects of food, like its shape.

Changing the pasta's shape, affecting both its visual appeal and texture, led participants to consume 14% more than when given their preferred shape [35].

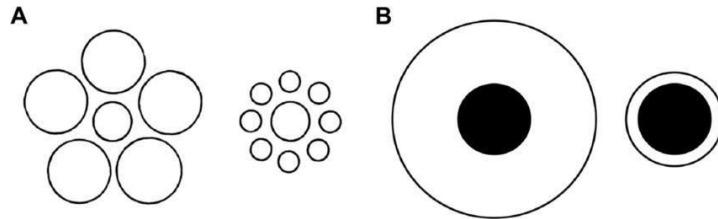


Fig. 3. Representations of the (A) Ebbinghaus-Titchener size-contrast illusion and (B) Delboeuf illusion



Fig. 4. The strawberry-flavoured mousse served from square, round and oval shaped plate

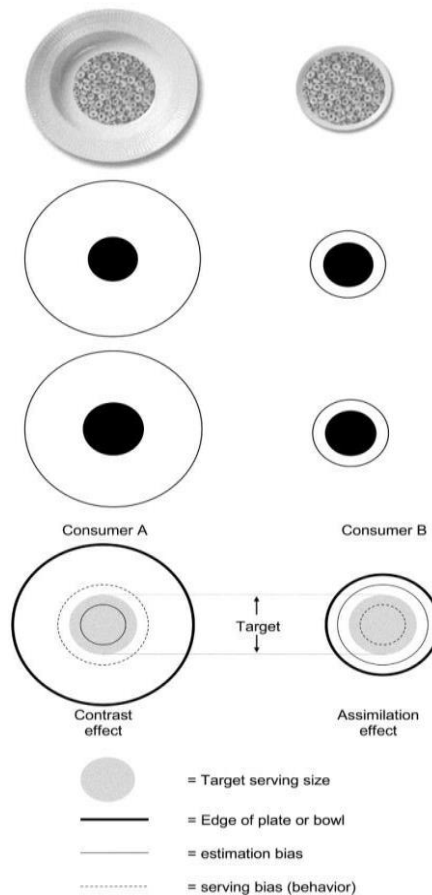


Fig. 5. Food on large vs. small plate (first row); standard Delboeuf illusion (second row); nonstandard Delboeuf illusion (third row); estimation and serving biases (fourth row)

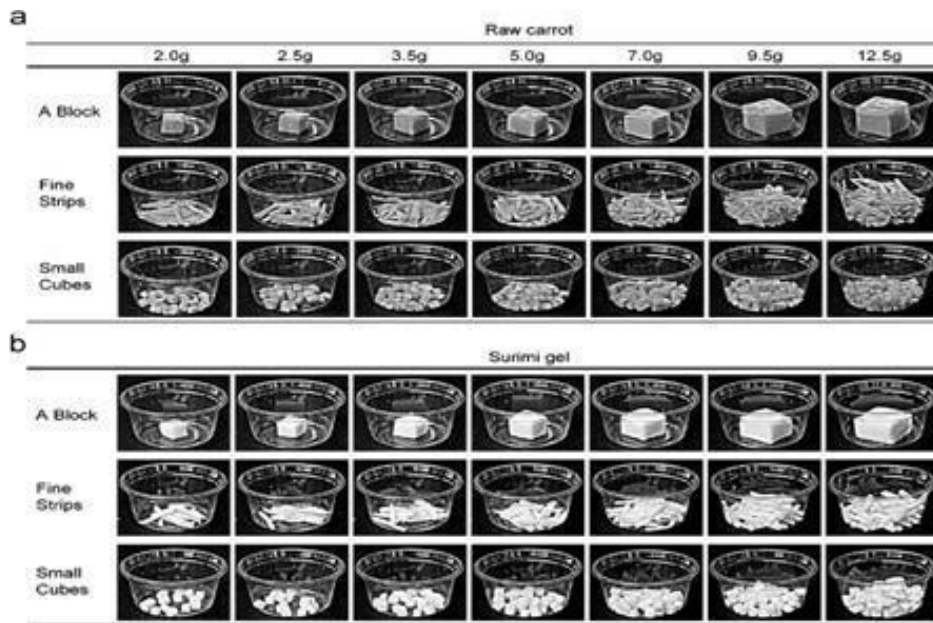


Fig. 6. Example of the pictures used as stimuli: (a)raw carrot, (b) surimi gel

In a study on visual perception and food, researchers manipulated the shapes of different food samples to investigate their impact on mass estimation. The samples included blocks, fine strips, and small cubes, displayed on a screen. Participants were tasked with selecting the image that represented a target mass. Raw carrots and surimi gel were used as food items, representing hard and soft samples. The findings strongly support the presence of a visual illusion, showing that food's appearance influences mass estimation accuracy. Participants tended to overestimate finely cut food, especially fine strips, while accurately assessing block samples, regardless of food properties. This overestimation increased with the actual mass, particularly with fine strips creating a larger apparent volume. These results reveal how food presentation can affect our visual judgment of mass based on apparent volume [36].

The liking of foods can also be influenced by the shapes of the food pieces. For instance, children preferred vegetables shaped like stars rather than being sliced or cut into sticks. Olsen et al. [37] and adults preferred pictures of meats cut into pieces than slices [38].

Nevertheless, altering the shapes of food had no discernible impact on the consumption of snack foods. Children's intake of snacks cut into enjoyable shapes (like animals, hearts, or hands) was not higher than that of snacks served in regular forms [39].

Van Ittersum and Wansink (2011) discovered that individuals poured less soup into smaller bowls compared to larger ones due to an overestimation of the smaller bowl's diameter. This same overestimation of portions in smaller bowls might also clarify why the quantity of food served in smaller bowls is less than in larger ones. As a result, consuming less energy occurs when using smaller bowls [40].

12. THE MATERIAL OF THE PLATE

12.1 Plate Materials and Cultural Influences

In the ancient times, Apicius, in his work "Cookery and Dining in Imperial Rome," recommended using an expensive silver platter to enhance the presentation of a dish (number 141). Today, a silver or gold finish charger plate can add a sense of luxury and refinement to table settings, although they're less common in modern dining establishments [41]. Beyond cultural and semantic associations, plate and cutlery materials emphasize the distinction between visual and non-visual characteristics. For example, the anticipated weight differences between plastic and silver spoons can trigger associations between weight and quality [42].

Tableware choices are influenced by the dining environment, with porcelain plates in upscale restaurants and silverware associated with high-

quality tradition, while fast-food joints typically use plastic or paper plates.

13. MAINTAINING BALANCE IN PLATING

Culinary aesthetics, encompassing elements like color, temperature, freshness, and shape, play a crucial role in shaping the dining experience and influencing customers. A study with 300 students emphasized that food presentation, including factors like color, shape, size, variety, tableware, and arrangement, significantly impacts appetites. Food developers can use this information to enhance culinary art and influence food choices [43].

Zellner et al. researched the impact of food arrangement, specifically considering balance and color, on visual appeal and willingness to sample food. They discovered that color heightened the appeal in balanced presentations but didn't affect unbalanced ones. Participants were more inclined to try monochrome presentations, although neither color nor balance influenced their overall liking of the food's taste. This suggests that adjusting these factors can impact a dish's perceived attractiveness but might not necessarily affect its flavor enjoyment [44].

In a follow-up study, they observed that while participants didn't give distinct attractiveness ratings to tahini color, they preferred the hummus from a more balanced presentation. In another part, they found that a disorderly-placed chicken salad in a lettuce salad was preferred over a

chicken salad shaped as a half-sphere in the middle of the lettuce [45].

Choosing the right plate involves considering size, color, material, and shape together, as recent research, like Stewart and Goss's study, highlights the importance of manipulating multiple factors simultaneously. For instance, cheesecake tasted 20% sweeter on a round white plate, which can help manage calorie intake while meeting sensory expectations.

Arranging food on a plate involves visual composition, including factors like food color, design, texture, and spatial arrangement. Researchers are investigating how element layout impacts reactions to a dish, with studies like Reisfelt et al.'s showing a preference for modern dishes over traditional ones, influenced by age [46,47].

The complexity of a dish is not solely determined by the variety of colors present. A study investigated the relationship between people's visual preferences and their perception of complexity when it comes to vegetables, fruits, and mixtures of fruits and vegetables. The key takeaway is that the visual composition of elements should not be overly simple or overly complex if you want a dish to be successful or visually appealing [48]. In a study comparing artistic food presentation to a simple tossed salad or neat arrangement, participants completed questionnaires before and after eating. The artistic presentation inspired by

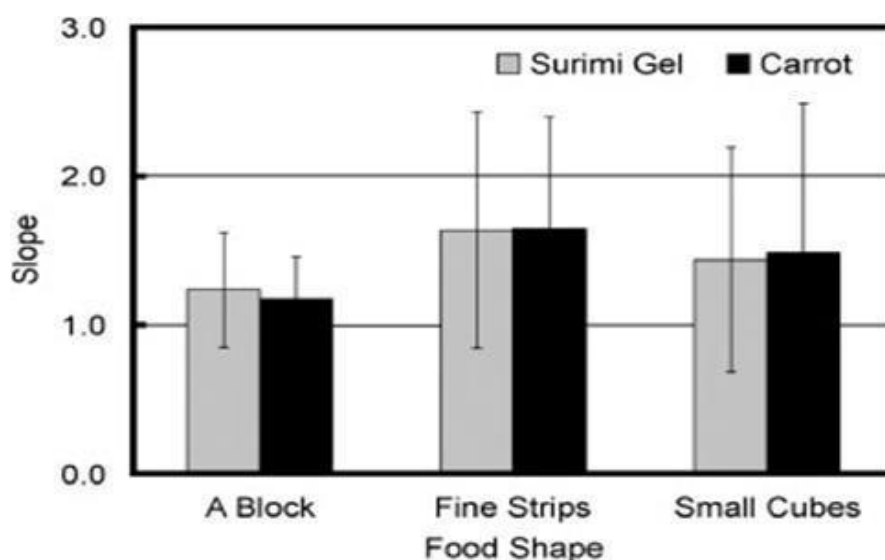


Fig. 7. Slope of regression line for each

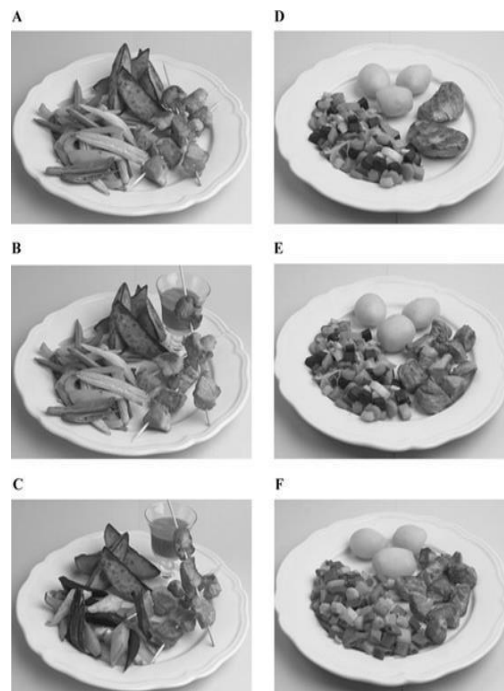


Fig. 8. A–C. Photos of the most preferred choices; D–F. Photos of the least preferred

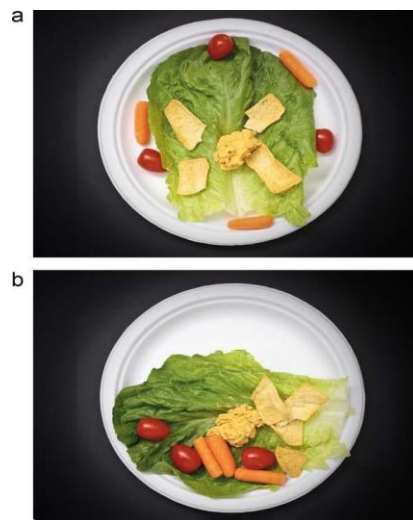


Fig. 9. a. Balanced presentation of the hummus plate; b. Unbalanced presentation of the hummus plate

Kandinsky led to the food being perceived as 36% more artistic and significantly more liked. While basic tastes weren't affected, the art-inspired condition was rated as 29% tastier overall. These findings highlight the significant influence of expectations on diners' hedonic and sensory perception [49].

As per the findings of Namkung et al. [50], the way food is presented plays a pivotal role in defining its quality. This aspect significantly

influences customers' appetites and their overall perception of the food's quality. The presentation of food is closely tied to its preparation and how it's showcased to the customers. [50].

Appealing food presentation is essential for dining satisfaction, including aspects like ambiance, cutlery, plates, arrangement, and portion size. High-end restaurants emphasize intricate preparations and captivating displays. This study helps food vendors attract customers

and establish a unique presentation style. Research suggests that tableware choice can enhance diners' well-being and overall sensory dining experience, complementing food quality.

14. DISCUSSION AND CONCLUSION

Proper execution of food decoration holds the potential to elevate the dining experience from good to outstanding. As a result, the art of food decoration is just as crucial to a dish as its flavor and taste.

Food Presentation Impacts Customer Choices
The visual appeal of a dish greatly influences how we perceive it. The presentation of food establishes our mood and sets the stage for how we experience its taste. Enhanced food presentation also leads customers to believe they are getting more value for their money, attributing it to high-quality ingredients and dedicated preparation.

In the era of social media, where every moment is captured and shared online, neglecting the visual appeal of food presentation could prove to be a marketing misstep for restaurants. The enticing presentation of food enables restaurants to tap into their current clientele and avenues, enabling them to showcase and promote their establishment on popular social media platforms such as Facebook and Instagram. The quality of the restaurant is often inferred from the visual appeal of its well-presented food, whereas poorly presented dishes can convey a sense of mismanagement and lower food quality, thereby communicating the restaurant's standard. Outstanding food display is achieved by skillfully blending the dish with sauces, garnishes, and sides. Therefore, food presentation enhances both the visual allure and the deliciousness of the recipe. The appearance and emotional impact of a plate establish the framework for how we will perceive the taste of the food.

Food presentation involves enhancing visual appeal through altering, processing, or arranging dishes. Clean plates are essential. Key presentation tips include considering plate shape for aesthetics and size for portion balance. Use the clock method for placing food items. Proportioning matters for both appearance and taste, with diverse garnishes adding to flavor and texture. Employ contrasting colors and height variation to enhance visual appeal. Viewing the plate as a canvas is crucial. This approach aims to elevate the dining experience, making it

multisensory and embracing molecular gastronomy. Eating goes beyond taste, challenging traditional ideas of flavor. Altered colors can influence taste perception. These innovative approaches offer insights into food science and provoke discussions on ethics and philosophy in manipulating sensory food experiences.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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