

Review Article

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

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 that 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, 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.

INTRODUCTION

“The first taste is always with the eyes.”

The initial impression is always visual. A dish serves as a canvas for chefs to showcase their skills and creativity, and the way it is plated can be seen as a fusion of flavor and presentation. Aesthetics and sophistication are crucial to the visual experience, as it is through sight that other senses are awakened. A

visually appealing and enticing presentation arouses the desire to taste the food. Conversely, an improper or unappealing display can conceal the magic and excitement that could entice the guest to try a dish that is exceptionally flavorful. Eating is an opportunity to indulge all our senses, starting with sight. 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.

BRIEF HISTORY OF FOOD DECORATION

In the 1700s, both Asia and Western Europe's affluent classes admired chefs who prepared and served visually stunning dishes. In Louis XIV's court, elaborate structures made of meticulously decorated and luxurious food adorned multi-tiered tables. The first significant change in food presentation standards occurred in the 1960s. To accommodate budget constraints during the 1956 Olympics, vegetables and starches were served on the same plate as the main course, setting a trend. From 1975 to 1985, chefs' creativity became a prominent and vital aspect of the dining experience. The use of decorative embellishments experienced a surge in popularity, including tomato skin "rose" shapes and an abundance of paper doilies positioned beneath and between plates. In the 1990s, food presentation reached new levels when tall, individual stacks composed of meat, starch, and vegetables emerged as a centerpiece on plates. Emeril Lagasse, a renowned chef, contributed to the trend by popularizing the act of garnishing the rim of each plate with herbs, dry seasonings, powdered sugar, or cocoa powder. As the 2000s unfolded, there was a shift from sprinkling to the extensive utilization of squirt bottles and the technique of "drizzling" sauces on both the plate and the food, resulting in plates adorned with sauce zigzags. As chefs and designers continue to introduce progressive individualization and experimentation in food presentation, the principles of harmony, balance, and attraction are being explored. 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 PRESENTATION OF ANCIENT PERIOD

FOOD DECORATION TECHNIQUES

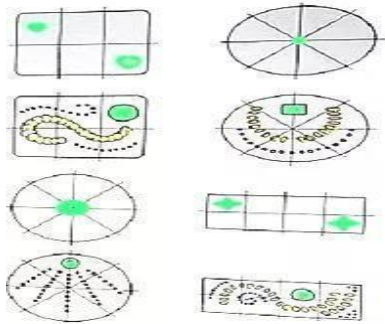
Food decoration techniques vary depending on the dish being prepared, which can be divided into four parts: the main dish, side dish, sauces, and garnish.–

1. Main Dish : The main dish is typically the heartiest and most substantial, often consisting of meat, fish, or another protein source.
2. Side Dish : Side dishes accompany the main course and can include items like rice, salad, and bread.
3. Sauce : Sauce are used to enhance the appearance, aroma, and taste of other foods, such as gravies and purees.
4. Garnish : Garnishes are decorative elements accompanying a prepared food dish, such as herbs, chopped raw onion, tomato, edible flowers, and more.

There are several techniques that can be utilized to achieve aesthetically pleasing food presentation.

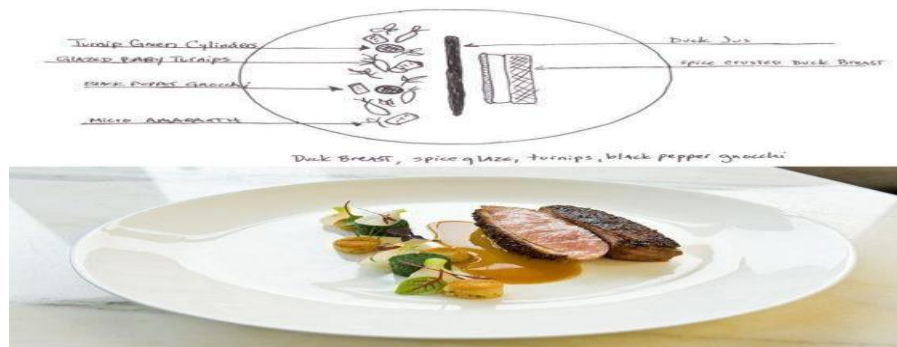
Planning the basic decoration

To achieve aesthetically pleasing food presentation, several techniques can be employed. Firstly, planning the basic decoration involves considering flavors, textures, quantities, and the balance between solids (e.g., rasgullas, jalebis, cakes) and liquids (e.g., sauces, jellies) to complement or contrast each other. Arranging portions in rows or lines, with curved or angled placements, can create an attractive dish.



Planning for visual variation

Planning for visual variation often involves sketching out food presentations beforehand, either on paper or using paper cut-outs. Chefs visualize the final dish and mentally divide the platter into equal parts to ensure a symmetrical and balanced layout. It's important to consider substance, textures, flavors, and colors on paper to avoid chaotic and unappealing arrangements.





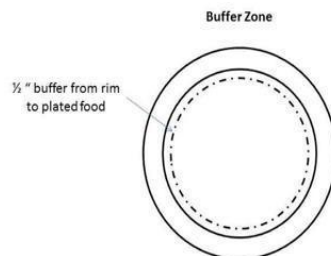
Balance Achieving balance involves filling the plate from the center and carefully considering textures and colors. Limiting the use of colors to two or three enhances their appeal. Touches of color can be added using various ingredients such as mithais, cakes, chocolate sauces, herbs, jellies, crumbled cakes, candied fruit, and spices. Ensuring that the flavors harmonize without overcrowding the plate is vital. When it comes to visually pleasing dishes, it is often better to use less. It is important to remember that less is always more, not only for the Indian audience but for all other audiences as well.

Highlight The Key Ingredient Highlighting the key ingredient can add elegance to the presentation. This can be achieved by incorporating eye-catching star ingredients, such as edible dust, flakes of warq, edible flowers, or candied jewel fruit.

Supporting Elements Supporting elements, such as vegetables and herbs, should complement the main ingredient rather than overshadow it. The plate should not be overcrowded with too many elements, providing variety in taste, color, shapes, and textures

Proportioning Proportioning food is crucial. Proportioning is important for both attractiveness and cost control. Proper proportioning ensures that main food items stand out and are not overwhelmed by garnishes or decorations. The size of the platter should be proportional to the amount of food, avoiding overcrowding or leaving it looking empty. Sufficient space between food items should be maintained to avoid a cluttered appearance.

Attention on Focal point



Determining a focal point before plating helps draw attention to specific elements. Bright or contrasting colors, elevation, and strategic food placement can be used to highlight items. It is common for the eyes to scan a food plate from the lower left to the upper right, so attention should be given to this visual flow.

- It is recommended to fill no more than two-thirds of the plate with food, leaving one-third as negative or empty space.
- A buffer zone of around half an inch from the rim to the flat of the plate should be maintained.
- Food plating should start from centre of the plate and build outward.

Complimentary Colours Consideration of complementary colors is crucial when plating food. For instance, if the food has predominantly white or brown tones, adding contrasting colors can enhance its visual appeal. Colors bring energy and contrast to the dish, and incorporating vibrant vegetables and fruits like beets, carrots, and cauliflower can make a striking difference on the plate.



Create Layers & Height On The Plate Creating layers and height on the plate is important for visual appeal. By strategically placing foods, it's possible to build height and give the illusion of a more substantial portion. Taller ingredients can be balanced by leaning flat, elongated items against them, but it's essential to ensure that the arrangement is stable and won't fall or tilt during transportation.
















Skeleton” Of Plate Design consists of simple geometric shapes that serve as the foundation for decoration. These shapes include lines, arcs, circles, and more.





- Strong, clean lines—whether vertical, horizontal, or angled—provide a sense of order and dimension to the plate.

These lines can be created using proteins, vegetables, or sauces. By repeating and intersecting these lines, patterns emerge, and additional food shapes and garnishes can be strategically placed to introduce variety and break the monotony.

- Arcs and swirls are used to soften the hard angular lines of the plate, adding fluidity and movement to its appearance. Curves are often created using sauces and purees.
- Free-form plating aims for an organized randomness that mimics a natural and spontaneous look. However, even in this style, thought and planning are still required, following similar visual rules of composition.

Table 1. SOME GEOMETRIC SHAPE PLATING

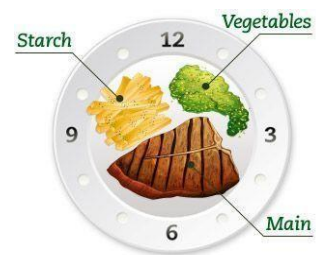
Single Line		
Two Lines		
Horizontal Lines		
Vertical Lines		
Two Lines – Crossing (like an X)		
Cantered Circle		
Circle and Line		
Arcs		

Arc & Line		
Swirl		

Timing (CLOCK METHOD PLATING)

Timing is crucial when it comes to food plating. It's important to avoid taking too much time to decorate or modify a dish, as it can result in the food becoming cold when it should be served hot, or vice versa. Including the plating time in the dish preparation is recommended. 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.



Design and Creativity with Sauces Sauces can be used to add visual interest to a dish. One sauce can be used for both flavor and presentation. One way to achieve this is by creating accent dots on one side of the plate or lightly drizzling the sauce over the main ingredients.



Match with Surrounding Theme The presentation and plating of a dish should match the surrounding theme. 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 Garnishing should be simple and clean, using edible ingredients that are already present in the dish. Chefs should not overlook the importance of decoration, as people eat with their eyes, and creative and thoughtful plating enhances both the visual appeal and taste of the food.

Styling When styling a dish, it's important to balance contrast and variety. Overdecorating a dish can have negative effects, making it unappealing or messy. Herbs and vegetables can be used to add color and flavor, and different sauces can enhance the colors and textures of the dishes.

The key factors in food presentation are color, arrangement, balance, texture, and ease of eating for guests.

PLATING TOOLS FOR DECORATING

● PERFECT PLATE SELECTION

Regarding plating tools, the choice of an ideal plate holds significant importance. Plates exhibit a range of colors, shapes, textures, and dimensions. The selection of dinnerware relies on the nature of the restaurant and the cuisine style presented. Plate size holds significance, influencing the perception of portion adequacy. Equally important is the plate's color, as it can amplify the food's visual allure and harmonize with specific food hues. Texture also factors in, considering both customer preferences and the overall setting.

Diverse plate varieties exist, including ceramic and glass options. Ceramic plates prove adaptable, suitable for both day-to-day meals and special occasions. Glass plates, valued for their versatility, are available in transparent or colored alternatives. While glass plates possess merits such as neutrality and non-interference with food flavors, they are susceptible to fragility and heaviness in comparison to other plate materials.

Plate Size

The size of the plate used in a restaurant depends on its style. For instance, family-style restaurants often use larger plates, while those that focus on small plates for sharing opt for smaller plates. Fine dining establishments typically utilize oversized plates, such as a 12-inch/30 cm dinner plate or a 7-9 inch/18-23 cm appetizer plate. These oversized plates serve as a canvas, creating negative space that frames the food, enhances its colors and characteristics, and draws attention to it. Moreover, larger plates prevent overcrowding and spills. The size of the plate influences the perception of portion size, as a larger plate can make a serving appear smaller. Conversely, smaller plates, bowls, or ramekins can be nested to highlight specific components. It's important to choose a plate size that allows the food to stand out while ensuring the portions don't appear too small or excessively crowded.

A Complementary Plate Colour

The color of the plate also plays a significant role. Plate color affects the overall presentation, our taste perception, and even our appetite. Chefs often prefer white plates because they act as a blank canvas that showcases the vibrant colors of the food. Black plates provide a contrasting backdrop for brightly colored dishes. Earth tones such as brown, tan, warm grey, and greens can be used effectively when paired with the appropriate food colors, resembling natural elements like dirt, moss, trees, and rocks. For example, green foods like salads and vegetables pair well with yellow plates, while beige foods like biriyani, pulao, pasta, chicken, and white rice complement black and brown plates. Red foods such as tomatoes, beef, and red sauces look appealing on white plates, while yellow and orange foods like eggs, corn, and curries pair well with blue plates. While solid colors are commonly used, some restaurants incorporate patterns as their signature style. The color of the plate not only affects the visual appearance of the food but also influences our perception of its appetizing qualities. Foods served on white plates tend to enhance sweet flavors, while black plates bring out more savory flavors. Interestingly, serving food on a red plate has been shown to reduce the amount diners eat. When selecting service ware, it's important to consider the food, its shapes, and its colors to create a harmonious presentation.

Colours effect not only how the food appears but also how appetizing it looks to us. Foods served on white plates tend to enhance sweet flavours in food, while black plates bring out more savoury flavours,

and serving food on a red plate has shown to reduce the amount diners eat. Service ware should be chosen to match the food, its shapes, and colours.

Plate Texture

Considering the customers and the venue is crucial when choosing the style of service ware. In the past, people used large leaves, gourd halves, or seashells as plates. With the discovery of clay, early pottery dinnerware became prevalent. Trenchers made of hard bread, wood, earthenware, or metal were commonly used until the 16th century, with bread trenchers being the most popular. Pewter plates were used in the Middle Ages but were limited to those who could afford them, while the poor used wooden trenchers. However, pewter could lead to lead leakage when it came into contact with highly acidic foods like tomatoes. Additionally, poor hygienic practices resulted in bacteria and worm transmission from wooden trenchers, leading to mouth sores.

- **Ceramic** These plates are highly practical and durable, suitable for long-term use. Ceramic plates come in various styles, ranging from everyday common plates to intricately decorated ones reserved for special occasions.



- **Glass Plates** Many people use glass plates regularly as they strike a balance between special and casual dining. Glass plates can be clear or colored, offering versatility in design. Glass plates have several advantages, such as being inert (not reacting with food), not affecting the flavor of the food, and effectively containing food and fluids unless cracked. Glass plates are also easy to recycle. However, they have some drawbacks, including **fragility** (susceptibility to fracture from strong impacts) and **weight**, which can make them challenging to hold for extended periods, particularly during buffet-style dining.



- **Stoneware Plates** Stoneware plates are made from non-porous ceramic and are known for their opaque appearance and durability. They are suitable for both casual and formal dining experiences.
- **Earthenware Plates** Earthenware plates are practical and affordable options made from pottery clay. They are fired at lower temperatures and are suitable for everyday dining and casual entertaining.

Earthenware and stoneware differ primarily in their maturation temperatures. While earthenware refers to various clay types that mature at lower temperatures, stoneware, encompassing mid-range and high-fire varieties, matures at higher temperatures.



- **Bamboo Plates** These plates emit an incredibly organic atmosphere, and for those inclined towards eco-friendliness, opting for such dishes is quite pragmatic. Bamboo plates exhibit impressive longevity, rendering them perfect for presenting even the most substantial meals without the concern of warping, breaking, or splitting. Their elegant and distinctive design imparts a hint of sophistication and individuality to every culinary masterpiece.



- **Paper Plates** Paper plates are the preferred choice for individuals in need of disposable tableware, commonly found at events like birthday parties and casual gatherings. Despite their widespread use over the years, they lack eco-friendliness.















- **Kansa** Kansa, known as Bell metal in English, constitutes a durable alloy primarily composed of bronze, featuring a copper-to-tin ratio of around 4:1. Varied regions refer to it by distinct names; for instance, it's termed "kanh" in Assam, and "Kansa" in West Bengal and Odisha. This alloy finds extensive application in the creation of culinary and dining tools. Its resilience against deterioration, along with its lustrous, scratch-resistant, and unblemished qualities, makes it an ideal choice for everyday use, retaining its integrity for many years. 
- **Porcelain or China** Porcelain and China are both terms used to describe dinnerware crafted from a refined clay mixture, usually containing metal, kaolin, and quartz. This blend is fired at elevated temperatures. Porcelain often boasts an elegant appearance, suitable for formal dining, while remaining suitable for everyday use, adding a touch of sophistication to any meal. Distinctly, Bone China stands as another variety of tableware. In its creation, bone ash, derived from animal bones, is combined with porcelain clay and fired at a slightly lower temperature compared to porcelain. This process yields an exceptionally lightweight and delicate material with a translucent, milky appearance. 
- **Stainless steel** Stainless steel, an iron-based alloy comprising various metals, becomes stronger and more durable upon their fusion. This alloy consists of at least 11% chromium, a component that prevents rusting and imparts heat-resistant characteristics to the iron. 

Table 2. Other types of plate

Service Plate	Service Plate, the largest in size (11 to 14 inches across), is positioned at the center of the setting before diners arrive. It serves as a base for appetizers, salad, and soup, and is not used for direct food consumption.	
Dinner Plate	The most frequently used plate is the Dinner Plate, which measures 10 to 11 inches in diameter and is utilized for serving the main course in both formal and informal meals.	
Luncheon Plate	The Luncheon Plate, about 9 to 9.5 inches in diameter, is employed for simpler meals and is not essential for either formal or informal occasions.	

<p>Round-Salad Plate</p>	<p>The larger Round-Salad Plate, around 8 to 8.5 inches in diameter, is presented after the main course is cleared during formal meals. A smaller version, 7 to 7.5 inches in diameter, is also used.</p>	
<p>Fish Plate</p>	<p>Distinctively ornamented, the Fish Plate (8 to 9 inches in diameter) showcases a fish pattern and is not part of regular dinnerware sets.</p>	
<p>Dessert Plate</p>	<p>Dessert Plates are used to desserts at the end of the meal and (7.25 to 8.5 inches in diameter) are designed for both formal and informal meals, separate from standard dinnerware sets.</p>	
<p>Cheese Plate</p>	<p>These plates are distinguished by their cheese-inspired designs and are specialized dishes, measuring around 7.25 inches in diameter. They find use in both formal and informal settings, existing independently from dinnerware sets.</p>	
<p>Tea Plate</p>	<p>Tea Plate: Tailored for tea time, these plates are approximately 7 to 7.5 inches in diameter. Their purpose is to hold teacups without saucers, some even featuring a shallow indentation.</p>	
<p>Fruit Plate</p>	<p>Fruit Plate: Adorned with fruit motifs, these specialized plates range from 6.25 to 8 inches in diameter. They are employed in both formal and informal dining scenarios and are not part of a larger dinnerware collection.</p>	


<p>Bread-and- Butter Plate</p>	<p>Typically used during casual meals and luncheons, these plates accommodate bread or butter. When no separate plate is provided, a slice of bread or roll is placed directly on the tablecloth or alongside the dinner plate, where the butter is also positioned.</p>	
<p>Fruit Saucer</p>	<p>Referred to as a fruit dish, side dish, or berry bowl, this small, shallow dish measures around 4 to 6 inches in diameter and has a depth of 1 inch. It serves the purpose of segregating juices that might flow from the foods placed within it.</p>	








The selection of these options depends on various factors. For instance, a fine dining establishment might opt for china or porcelain to convey elegance. A more casual restaurant could go with ceramic or stoneware to match a rustic dining experience, while a fast-food operation might choose cost-effective plastic and melamine. An off-premise catered location might find eco-friendly, disposable, and compostable bamboo or recycled material service ware suitable. Service ware also encompasses materials like glass, wood, slate, tile, and metals such as cast iron or stainless steel. Some chefs prefer personalized plates to distinguish their cuisine, using natural materials, reclaimed wood, or architecturally distinctive designs that match the artistic nature of the food itself.

Plate Shape

A diverse selection of plates and service ware is available in various geometric forms, encompassing traditional round shapes, along with square, oval, or rectangular designs. Unique options like teardrop, oblong, or spoon-shaped variations also exist. The correlation between the plate's shape and the dish it holds holds significance in the realm of decoration. Notably, research indicates that using angular plateware can accentuate the bold flavors of a dish, underscoring the importance of this match.

Table 3. *Types of plate shape*

Types	Picture reference
Round - shaped plate	

Oval - shaped plate	
Square - shaped plate	
Rectangular - shaped plate	
Drop - shaped plate	
Oblong - shaped plate	
Leaf - shaped plate	
Spoon - shaped plate	

ADDITIONAL PLATING TOOLS FOR DECORATING

Ensuring proper food presentation and having the right plating tools are crucial for achieving high-quality plating. Below are essential items for food decoration:

Decorating Brushes

These versatile tools are essential in a chef's toolkit, serving various purposes from intricate details to broad strokes when applying sauces, plating purees, or arranging coulis beneath ingredients.



Garnishing Kits

These kits contain all the necessary tools like plating wedges, tongs, squeeze bottles, and brushes for garnishing signature dishes effectively.



Molds

Molds play a crucial role in food presentation. By precisely shaping and sizing ingredients, you enhance the plate's visual allure and maintain its cleanliness. The utilization of ring molds contributes to creating elevation and structure when assembling various elements.



Plating and Precision Tongs

An essential addition to your toolkit is precision tongs, aiding in placing delicate garnishes and small foods with finesse. Many tongs even incorporate micro-serrations to ensure better grip and stability. Similarly, plating wedges, available in flat, round, or pointed forms, are perfect for skillfully spreading sauces and soft components in artistic designs on the plate.



Plating Wedges

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Shavers

Shavers are adept at grating hard cheeses, chocolate, and tender vegetables, adding a refined touch to the final presentations.



Spoons and Knives

Maintaining a diverse selection of spoons is equally vital. Saucier spoons come into play for elegantly sweeping sauce smears across the plate. Opting for a utensil with a tapered bowl proves ideal for precision drizzling and pouring. Furthermore, slotted spoons efficiently distinguish solids from liquids once the presentation is complete.



Palette Knife

A frosting spatula or palette knife serves as a specialized tool for spreading substances on flat surfaces, such as cake frosting. It's also perfect for applying spreads onto sandwiches in larger quantities.



Squeeze Bottles

Squeeze bottles excel at applying sauces or aiolis onto plated dishes. These often feature adjustable, precision control tips to ensure the precise amount is dispensed.



Peeler

A peeler, a handy kitchen gadget, easily transforms a variety of fruits and vegetables into thin, elegant strips.



The saying "we eat with our eyes" underscores the significance of visually appealing food presentation. The aesthetics of food hold a comparable importance to its taste and texture, influencing expectations, experiences, and memories associated with a dish. The presented dishes must captivate and whet the appetite. Furthermore, the presentation of the dining venue itself is equally crucial, recognizing that initial impressions create a lasting impact, often being established within the first few seconds.

AIMS & OBJECTIVES

The visual appeal of a dish is as crucial as its taste, as food decorations play a pivotal role in elevating meal presentations. Conversely, plain and uninteresting food lacks attractiveness and

doesn't whet the appetite. A meticulously adorned dish not only enhances its beauty and desirability but also increases its allure in various ways:

1. **Visual Allure:** Our perception of food begins with our eyes, preceding even the taste and aroma experiences. Garnishes introduce vibrant colors that entice our eyes even before we taste the flavors or smell the aromas.
2. **Appetite Stimulation:** Eating is a multisensory experience where our eyes assess food before our mouths even sample it. Through garnishes and colorful elements, the appeal of the dish is heightened, thus stimulating the appetite.
3. **Enhanced Flavor:** Garnishes can amplify the taste of specific dishes. For instance, serving seafood with lemon wedges not only introduces a visual yellow contrast but also allows diners to infuse the food with the lemon's zesty flavor. A sprig of mint atop a fruity dessert subtly imbues the dish with the herb's rejuvenating taste. Hence, it's crucial to select garnishes that harmonize with the dish's flavor profile.
4. **Identification of Dishes:** Some dishes aren't immediately recognizable solely based on appearance. Distinguishing between a savory carrot soup and a sweet pumpkin dessert soup, both sharing a deep orange hue and thick consistency, can be challenging. Incorporating a curl of carrot atop the carrot soup or a sprinkle of brown sugar and cream swirl on a pumpkin soup aids diners in identifying their impending delight."

REVIEW OF LITERATURE

Food decoration involves modifying, processing, arranging, or adorning food to enhance its visual appeal. The presentation of food holds significant importance for both chefs and food enthusiasts. It goes beyond mere decoration, as it plays a role in enhancing the perceived taste for customers. Properly arranging and serving food is highly appreciated by customers, making it an essential aspect of the overall dining experience. However, considering food decoration merely as ornamentation is a narrow perspective. 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 (*Kahneman, D., Diener, E., & Schwarz, N. (Eds.). (1999). Well-being: Foundations of hedonic psychology. Russell Sage Foundation.*).

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. These subtle influences, often unnoticed, can affect how we perceive food. Beyond functionality, the decorative aspects of tableware hold cultural significance, emphasizing the value of the practices they're used for. Essentially, decorative plates and utensils create a framework that accentuates the food and its

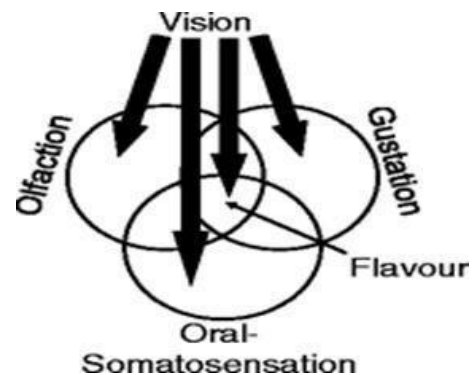
consumption. Chefs are meticulous in their selection of serving vessels, utensils, and even non-edible garnishes to ensure that each dish enhances the overall dining experience.

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, 2014, 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. (Wadhera, D., & Capaldi-Phillips, E. D. (2014). A review of visual cues associated with food on food acceptance and consumption. *Eating behaviors*, 15(1), 132-143.)

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 (study titled "van der Laan, L. N., De Ridder, D. T., Viergever, M. A., & Smeets, P. A. (2011). The first taste is always with the eyes: a meta-analysis on the neural correlates of processing visual food cues. *Neuroimage*, 55(1), 296-303.).

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 (Williams, A. A., & Arnold, G. M. (1991). The influence of presentation factors on the sensory assessment of beverages. *Food quality and preference*, 3(2), 101-107.).



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. The mere sight of well-presented dishes has the power to captivate individuals and has evolved into a pivotal component of the multisensory eating encounter.

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. Effective plating succeeds when it manages to entice diners by making the dishes visually appealing. From the very inception of the dish's appearance on the plate to the final bite, the attraction remains consistent. This underscores the pivotal role of the person responsible for plating, as they contribute significantly to the holistic multisensory dining experience (Deroy, O., Michel, C., Piqueras-Fiszman, B., & Spence, C. (2014). *The plating manifesto (I): From decoration to creation. Flavour, 3(1), 1-11.*).

Food presentation extends beyond mere aesthetics; it serves as a tangible indicator of quality for customers. It holds the power to shape initial expectations about the food. Covering a spectrum of menu items, including soups, appetizers, main courses, and desserts, the presentation involves artfully adapting sauces and garnishes. 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 (Radzi, S. M., Bakhtiar, M. F. S., Mohi, Z., Zahari, M. S. M., Sumarjan, N., Chik, C. T., & Anuar, F. I. (Eds.). (2014). *Theory and practice in hospitality and tourism research. CRC Press.*).

Consequently, the visual aspect of food presentation inevitably influences eaters' anticipation of taste and aroma quality, as well as their overall hedonic value. Customers' perceptions are often driven by what they observe, significantly shaping their dining experiences (Spence, C. (2012). *The development and decline of multisensory flavour perception. Multisensory development, 63-87.*).

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. in 2013 ("Piqueras-Fiszman, B., Giboreau, A., & Spence, C. (2013). *Assessing the influence of the color of the plate on the perception of a complex food in a restaurant setting. Flavour, 2, 1-11.*) 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.

PLATE IN FOOD DECORATION

Selecting the appropriate plate format tailored to a particular dish holds significant significance. As an illustration, it's imperative that the dish doesn't appear overly congested; rather, it should effectively communicate that the portion size is substantial and not overly paltry. 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). While factors like the flavor and sweetness intensity of the desserts were primarily influenced by the dessert type, the degree to which these attributes were impacted also bore a relation to the chosen plate.

- **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. Chefs predominantly utilize white plates to showcase their culinary creations, occasionally opting for black plates as well. In certain dining establishments, chefs employ charger plates, which are large flat dishes positioned beneath regular plates for decorative purposes. These charger plates are presented in primary colors such as blue, red, and green, assigning a distinct hue to each diner. 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. The interplay of factors like ambiance, setting, temperature, sound, color, as well as tactile and cognitive cues, are processed by the brain, generating distinct perceptions of flavor even before the food touches the palate (as demonstrated in *Spence, C., & Piqueras-Fiszman, B. (2014). The perfect meal: the multisensory science of food and dining. John Wiley & Sons.*).



There have been intuitive and untested rules regarding the choice of colored plates. For example, it is often believed that purple grapes do not look appealing when served on a blue plate. 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. On the other hand, the color green is considered healthy and abundant. Green foods are commonly found in salads, and products marketed as natural

often come in green packaging. Many people are attracted to the color green and associate it with healthy eating. However, it is only in recent years that these anecdotal claims about the impact of plateware color on appetite, taste, or flavor have been scientifically evaluated (mentioned in *Achterberg, C. L. (1989). A Psychology of Food: More Than a Matter of Taste. Journal of the American Dietetic Association, 89(6), 870-872.*).

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). The study found that in many cases, the concentration of the tastant (a water-soluble chemical that produces taste sensation) had to be increased for participants to detect its presence in colored solutions compared to uncolored solutions. For instance, adding green coloring to a sweet solution significantly heightened taste sensitivity, while yellow coloring decreased it. Interestingly, red coloring had no significant effect on sensitivity to sweet taste. Regarding sour taste sensitivity, both yellow and green coloring decreased participants' sensitivity, while red coloring had no effect. Coloring a clear solution red reduced sensitivity to bitter taste, whereas yellow and green coloring had no such effect. Lastly, adding color had no impact on taste detection thresholds for salt solutions (study titled " *Maga, J. A. (1974). Influence of color on taste thresholds. Chemical senses, 1(1), 115-119.*).

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 (mentioned in the book " *Gallace, A., & Spence, C. (2014). In touch with the future: The sense of touch from cognitive neuroscience to virtual reality. OUP Oxford.*).

✓ **THE RELATION BETWEEN COLOUR AND FLAVOUR OF THE PLATE**

Colour and flavour are two of the primary factors that can influence food acceptability. Several studies have demonstrated that people normally associate certain food with specific colours and when the colours of these products are intentionally altered, their recognition is diminished .

Following this interpretation, the colour of the mousse served in another study may have appeared more salient when set against the background of the white plate than when served from the black plate. Thus, the rated intensity of the food's taste (that is, its sweetness or saltiness) will presumably have been influenced by its perceived colour saturation, which, in turn, will have been influenced by the colour saturation of the plate itself. Another possibility, coming from the documented effects of colour saturation on smell intensity is that the contrast improved the olfactory component of the food, and in this way affected the participants' overall flavour appreciation. (" *Piqueras-Fiszman, B., Laughlin, Z., Miodownik, M., & Spence, C. (2012). Tasting spoons: Assessing how the material of a spoon affects the taste of the food. Food Quality and Preference, 24(1), 24-29.*)

Another study investigate how the sensory properties of food can lead to a decrease in the pleasantness of that food after it is eaten. After eating chocolates of one colour the pleasantness of the taste of the eaten colour declined more than of the non- eaten colours, although these chocolates differed only in appearance. The presentation of a variety of colours of chocolates, either simultaneously or successively, did not affect food intake compared with consumption of the subject's favorite colour. ("Rolls, B. J., Rowe, E. A., & Rolls, E. T. (1982). *How flavour and appearance affect human feeding. Proceedings of the Nutrition Society, 41(2), 109-117.*)

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. ("Spence, C., Levitan, C. A., Shankar, M. U., & Zampini, M. (2010). *Does food color influence taste and flavor perception in humans?. Chemosensory perception, 3, 68-84.*)

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. (" Harrar, V., Piqueras-Fiszman, B., & Spence, C. (2011). *There's more to taste in a coloured bowl. Perception, 40(7), 880-882.*)

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). Over the course of two-week of the study, three different desserts were served . The results demonstrated that the colour of the plateware exerted a significant influence on people's perception of the food, but that this effect varied as a function of the type of dessert that was served.



Desserts served on different coloured plates at the *Institut Paul Bocuse Research Centre in the study by Piqueras-Fiszman et al.2011*

The relationship between color and flavor of the plate has been explored in various studies. 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. For example, in one study, the color of the mousse appeared more noticeable when served on a white plate compared to a black plate. This perceived color saturation influenced the rated intensity of the food's taste, such as its sweetness or saltiness. Additionally, the contrast between the food and the plate may have improved the olfactory component of the food, thereby impacting the overall flavor appreciation of the participants (mentioned in the study " *Piqueras-Fiszman, B., Laughlin, Z., Miodownik, M., & Spence, C. (2012). Tasting spoons: Assessing how the material of a spoon affects the taste of the food. Food Quality and Preference, 24(1), 24-29.*).

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 (study titled " *Rolls, B. J., Rowe, E. A., & Rolls, E. T. (1982). How sensory properties of foods affect human feeding behavior. Physiology & Behavior, 29(3), 409-417.*).

Visual cues, when conflicting with olfactory stimuli, have been found to significantly influence odor judgments and distract individuals from making accurate assessments. A study investigated the role of food coloring in understanding the depth of a particular taste or taste attribute and its impact on the perception of flavor identity (study by *Spence, C., Levitan, C. A., Shankar, M. U., & Zampini, M. (2010). Does food color influence taste and flavor perception in humans?. Chemosensory perception, 3, 68-84.*).

Furthermore, the color of the bowl in which food is served has been shown to affect the taste perception. For example, popcorn was perceived as saltier when eaten from a colored bowl compared to a white bowl, and vice versa for sweet popcorn (study titled " *Harrar, V., Piqueras-Fiszman, B., & Spence, C. (2011). There's more to taste in a coloured bowl. Perception, 40(7), 880-882.*).

In a recent study, the influence of plateware color (black and white plates) on the gustatory and hedonic experiences of complex desserts was tested. The results indicated that the color of the plateware significantly influenced people's perception of the food, but the effect varied depending on the type of dessert. Interestingly, each plate consistently elicited a specific perceptual pattern for each dessert. Higher scores were obtained for attributes such as appetizing appearance, color intensity, flavor intensity, and overall liking when the same plate was used for each dessert. However, these results couldn't be solely explained by contrast effects. For example, participants rated the dessert with a darker brownish hue more highly when served on a black plate, while the other desserts (red and creamy) were rated as more delicious when served on a white plate (study by *Piqueras-Fiszman, B., Harrar, V., Alcaide, J., & Spence, C. (2011). Does the weight of the dish influence our perception of food?. Food Quality and Preference, 22(8), 753-756.*)

In conclusion, although the exact explanations for how plate color impacts taste and flavor perception are not fully understood, a growing body of research suggests that the color of the plate plays a functional role beyond decoration. These findings should encourage chefs and those in the catering industry to carefully consider the color of their plateware and its potential effects on customers' perception of taste and flavor.

- **THE SIZE OF THE PLATE**

Psychologists have found that the size of plateware can have a significant impact on people's eating behavior, particularly when it comes to determining how much food to serve themselves and how much they end up consuming. Over the past century, the average size of plates has increased by approximately 20%, paralleling the increase in average human waist size.

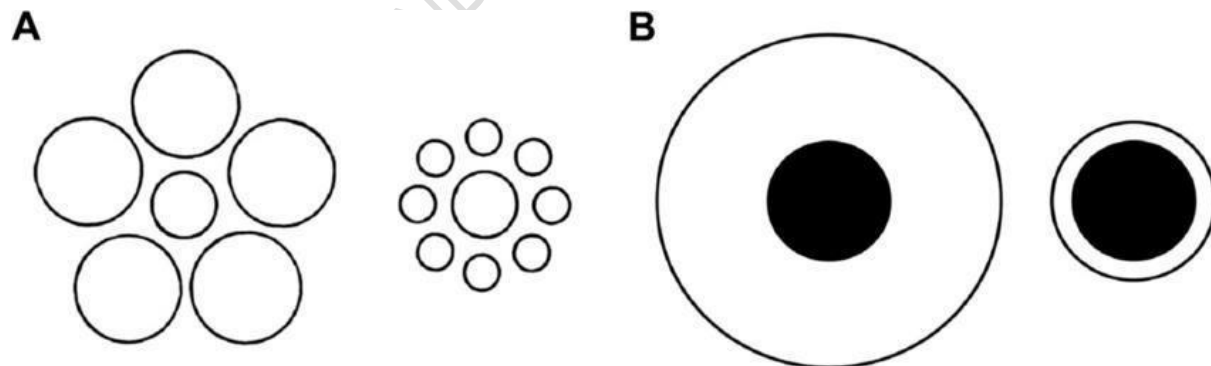
In a study examining the effect of bowl size on food consumption during a social event, researchers discovered that participants given larger bowls served themselves over 50% more ice cream compared to those given smaller bowls. Furthermore, since the participants tended to finish their food, those eating from larger bowls ended up consuming a significantly greater amount of ice cream overall. (*Wansink, B., Van Ittersum, K., & Painter, J. E. (2006). Ice cream illusions: Bowls, spoons, and self-served portion sizes. American journal of preventive medicine, 31(3), 240-243.*)

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. (“Van Kleef, E., Shimizu, M., & Wansink, B. (2012). *Serving bowl selection biases the amount of food served. Journal of nutrition education and behavior*, 44(1), 66-70.)

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 . (“ Van Kleef, E., Shimizu, M., & Wansink, B. (2012). *Serving bowl selection biases the amount of food served. Journal of nutrition education and behavior*, 44(1), 66-70.).

Wansink and his team tried to explain the outcomes by referring to the Ebbinghaus-Titchener size-contrast illusion and/or the Delboeuf illusion. In the most renowned version of the former phenomenon, a circle seems larger if it's enclosed by smaller circles compared to an identical circle surrounded by larger circles. The latter illusion tricks one into perceiving that between two identical circles, the one encircled by a larger ring will appear smaller than the one without a ring or surrounded by a smaller ring. Wansink and his colleagues proposed that these visual tricks might have led to the perception of a certain amount of food being much smaller when placed against the backdrop of a larger bowl, and conversely, appearing larger when presented in a smaller bowl. (Wansink, B., & Cheney, M. M. (2005). *Super bowls: serving bowl size and food consumption. Jama*, 293(14), 1727-1728.)



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

Notably, the impact of plate size on a diner's eating habits shows some degree of inconsistency. For instance, in three distinct laboratory-based studies, Rolls et al. couldn't establish a significant

correlation between plate diameter (17, 22, or 26 cm) and the quantity of food consumed during a meal.(Rolls, B. J., Roe, L. S., Halverson, K. H., & Meengs, J. S. (2007). *Using a smaller plate did not reduce energy intake at meals. Appetite, 49(3), 652-660.*)

It's noteworthy that while *Rolls et al. (2007)* examined consumption behavior in a controlled environment, *Wansink et al. (2005)* gathered participant responses through questionnaires at an actual company picnic. This contrast between Wansink et al.'s positive findings and Rolls et al.'s lack of significant results suggests potential variations in people's food consumption behaviors between lab settings and more practical dining scenarios.

The significance of portion size primarily lies in its connection to people's health, particularly concerning various quantitative methods of eating. For instance, Rozin and colleagues pointed out that the 'French paradox,' which involves differences in health outcomes between France and the US, can be attributed to variations in portion size. Despite consuming meals with higher saturated fat content and fewer fat-reduced foods compared to Americans, the French have a lower obesity rate and a reduced risk of heart disease. This contrast is attributed to the smaller portion sizes in full-service restaurants, buffets, supermarkets, and even in recipes found in cookbooks in both countries.(*Rozin, P., Kabnick, K., Pete, E., Fischler, C., & Shields, C. (2003). The ecology of eating: smaller portion sizes in France than in the United States help explain the French paradox. Psychological science, 14(5), 450-454.*)

The size of the food portion has been identified as a significant environmental factor that impacts short-term energy consumption. Both real-world and controlled experiments have been carried out to explore the influence of portion size on energy intake. These experiments consistently reveal that when the size of the food portion increases, individuals tend to consume more energy. Despite the well-established impact of portion size on energy intake, the precise mechanisms underlying this effect remain poorly comprehended. Some indications suggest that factors such as sensory cues (like visual and olfactory cues), cognitive elements (such as learning, social norms, and financial considerations), and outcomes after consumption (such as feelings of hunger and fullness) might combine to influence the amount of food people consume during a meal.

- **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.(*Gal, D., Wheeler, S. C., & Shiv, B. (2007). Cross-modal influences on gustatory perception. Available at SSRN 1030197.*)

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. (*Piqueras-Fiszman, B., Alcaide, J., Roura, E., & Spence, C. (2012). Is it the plate or is it the food? Assessing the influence of the color (black or white) and shape of the plate on the perception of the food placed on it. Food quality and preference, 24(1), 205-208.*)



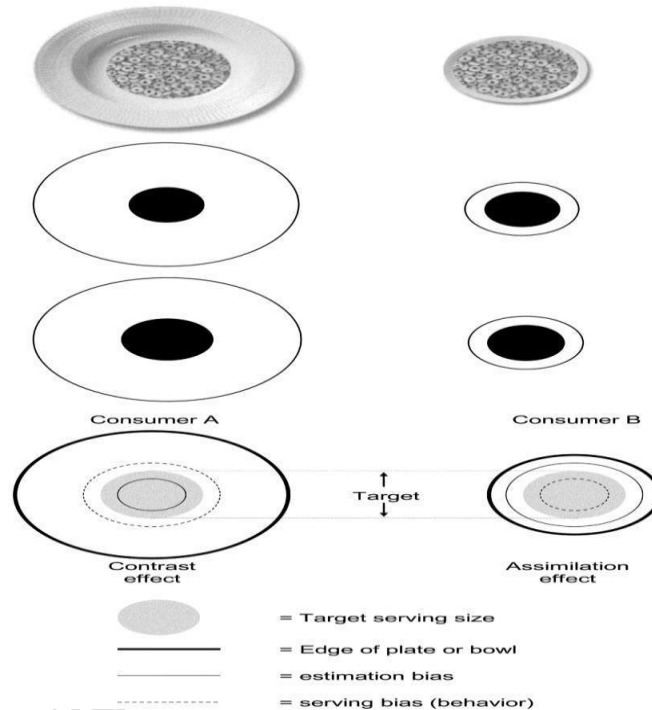
The strawberry-flavoured mousse served from square, round and oval shaped plate

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. (*Spence, C., & Piqueras-Fiszman, B. (2014). The perfect meal: the multisensory science of food and dining. John Wiley & Sons.*)

Yang proposes that the selection of tableware follows a law of opposites, where round-shaped food is paired with square or elongated dishes. This raises questions about how the shapes perceived during dining translate into the words diners use to describe their food.

Despite the debated idea that larger dinnerware leads to larger servings, it remains unclear what triggers this and who is most susceptible. Research from five studies indicates that the 'Delboeuf illusion' might clarify how dinnerware size contributes to biases, causing people to over-serve on bigger plates and bowls, and under-serve on smaller ones. A sinusoidal relationship is found between these biases and the gap between food and dinnerware edges. Although hard to eliminate through attention and education, altering the color of dinnerware or tablecloths could help mitigate these biases. By explaining how the 'Delboeuf illusion' mechanistically influences serving and intake based on dinnerware size, this study introduces the potential to connect illusions with eating behavior and suggests that simple design changes can enhance consumer well-being. (*Van Ittersum, K., & Wansink, B. (2012). Plate size and color suggestibility: The Delboeuf illusion's bias on serving and eating behavior. Journal of Consumer Research, 39(2), 215-228.*)

DINNERWARE SIZE AND THE DELBOEUF ILLUSION



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

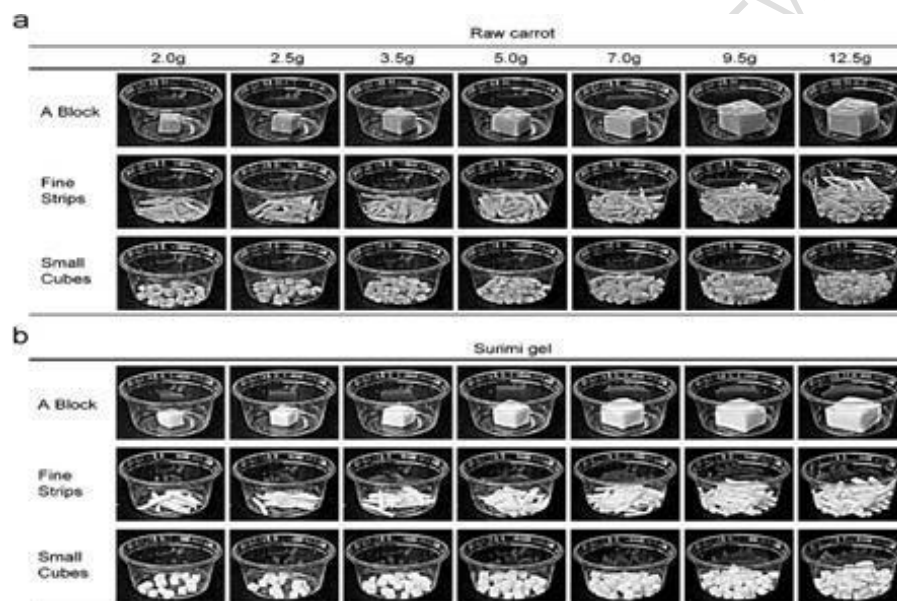
In a different study, researchers aimed to explore whether there are strong connections between shapes and cheese that people exhibit. In Experiment 1, which took place at a Gastronomy event, participants sampled three aged farmhouse cheeses (Keen's Cheddar, Tunworth, & Berkswell). Each cheese was rated by participants using a single scale with rounded and angular shapes at either end. Noteworthy variations in shape symbolism were noted among the three cheeses. In Experiments 2 (conducted with cheesemongers and cheese experts) and 3 (involving customers at a cheese store), participants individually rated the smell, taste, and mouth-feel attributes of different cheeses (Tunworth, Lancashire, and Stawley) on an angular-rounded continuum. The results indicated that the connections participants formed between senses were primarily driven by taste rather than smell or texture. The implications of these findings for dairy product marketing are also discussed. (Spence, C., Ngo, M. K., Percival, B., & Smith, B. (2013).

Crossmodal correspondences: Assessing shape symbolism for cheese. Food Quality and Preference, 28(1), 206-212.)

- **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. (“Kridler, R. E., Raghurir, P., & Krishna, A. (2001). *Pizzas: π or square? Psychophysical biases in area comparisons. Marketing Science, 20(4), 405-425.*)

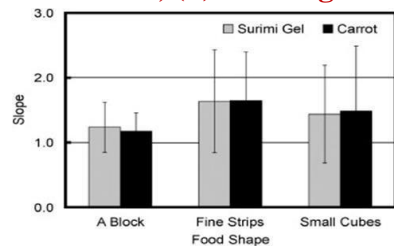
Sensory-specific satiety extends to the visual aspects of food, including its shape. Alterations in the form of food, impacting both its visual appeal and texture, were investigated by providing participants with three consecutive courses of pasta in varying shapes. Consequently, they consumed 14% more than when they were presented only with their preferred shape. (“Rolls, B. J., Rowe, E. A., & Rolls, E. T. (1982). *How flavour and appearance affect human feeding. Proceedings of the Nutrition Society, 41(2), 109-117.*)



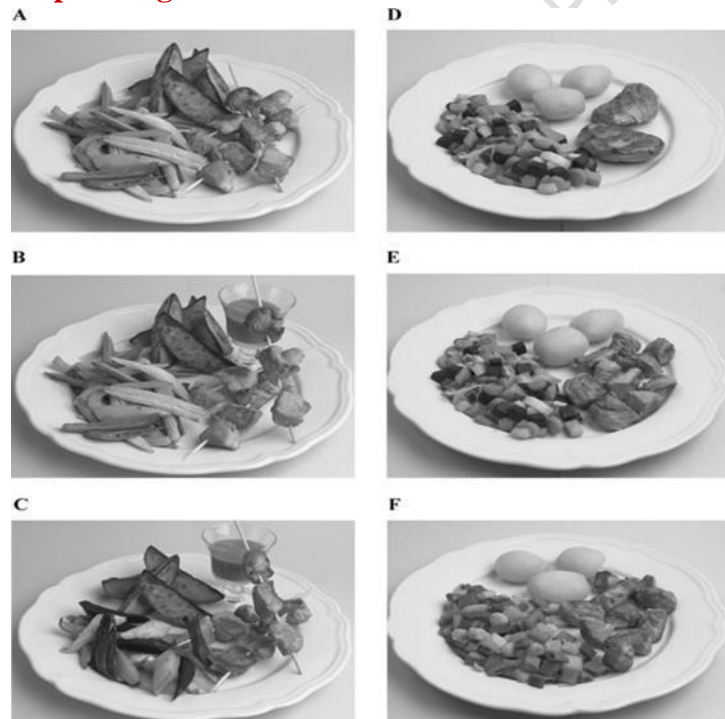
A study explored how the visual perception of cut food influences the estimation of mass. During the experiment, researchers manipulated the shape of food samples with varying masses, such as blocks, fine strips, and small cubes. These samples were displayed on a CRT screen. Eleven participants were involved in tasks where they had to select the food picture that seemed to represent a specific target mass. The food items used were raw carrots and surimi gel (made from ground fish), representing hard and soft samples respectively. The findings strongly support the existence of an illusion, revealing that the appearance of food impacts the accuracy of visual mass estimation. Notably, participants tended to overestimate the mass of finely cut food,

particularly fine strips, whereas they could accurately assess the mass of block samples, irrespective of the food's physical properties. This overestimation of mass for cut food intensified as the actual mass of the food increased, particularly when the fine strips created an increased apparent volume. These results indicate that visual illusions linked to food presentation affect how we visually judge the mass of a food sample based on its apparent volume. (Wada, Y., Tsuzuki, D., Kobayashi, N., Hayakawa, F., & Kohyama, K. (2007). *Visual illusion in mass estimation of cut food*. *Appetite*, 49(1), 183-190.)

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



Slope of regression line for each



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, A., Ritz, C., Kramer, L., & Møller, P. (2012). *Serving styles of raw snack vegetables. What do children want?*. *Appetite*, 59(2), 556-562.) and adults preferred pictures of meats cut into pieces than slices ("Reisfelt, H. H., Gabrielsen, G., Aaslyng, M. D., Bjerre, M. S., & MØLLer, P. E. R. (2009). *Consumer preferences for visually presented meals. Journal of Sensory Studies*, 24(2), 182-203.).

A–C. PHOTOS OF THE MOST PREFERRED CHOICES;

D–F. PHOTOS OF THE LEAST PREFERRED

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, as indicated in the study titled "Boyer, L. E., Laurentz, S., McCabe, G. P., & Kranz, S. (2012). *Shape of snack foods does not predict snack intake in a sample of preschoolers: a cross-over study. International Journal of Behavioral Nutrition and Physical Activity*, 9(1), 1-7)

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, as discussed in "Van Ittersum, K., & Wansink, B. (2012). *Plate size and color suggestibility: The Delboeuf illusion's bias on serving and eating behavior. Journal of Consumer Research*, 39(2), 215-228."

While matching plate shapes with dishes might appear too elaborate for many diners, there is surprisingly limited research on the influence of plateware shape on people's perception of the food presented on it. Consequently, it can be inferred that the shape of dinnerware also has the potential to impact taste.

- **THE MATERIAL OF THE PLATE**

PLATE MATERIALS AND CULTURAL INFLUENCES

The choice of material for plates and cutlery has a significant impact on the cultural aspects of dining. Research indicates a link between plate material and eating behavior.

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. ("Cookery and

Dining in Imperial Rome"; Apicius, Joseph Dommers Vehling- Vehling, J. D. (Ed.). (2012). *Cookery and dining in imperial Rome*. Courier Corporation.)

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. ("Piqueras-Fiszman, B., & Spence, C. (2012). *The weight of the bottle as a possible extrinsic cue with which to estimate the price (and quality) of the wine? Observed correlations*. *Food Quality and Preference*, 25(1), 41-45.)

In essence, one wouldn't expect porcelain plates in fast-food joints or on airplanes (unless flying business class), just as plastic or paper plates wouldn't be suitable in upscale restaurants. Although silverware is less common nowadays, it has always been linked to high-quality tableware, a tradition passed down from our ancestors.

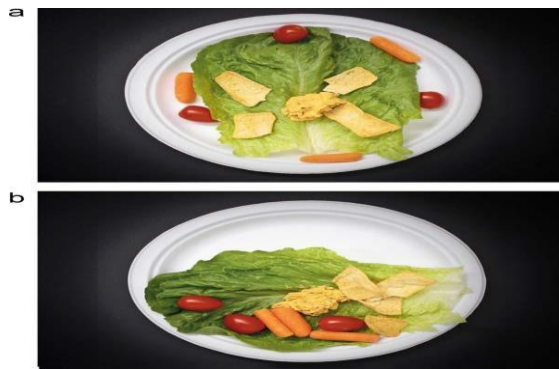
- **MAINTAINING BALANCE IN PLATING**

Maintaining the equilibrium of a dish holds crucial importance in the realm of culinary aesthetics. Each individual ingredient utilized in plating exerts an influence on the overall presentation of the food. Various components of food presentation, such as color, temperature, assortment, freshness, shape, and the tableware materials, must harmonize on the plate to enhance its appeal. These elements within a food arrangement can function as tools for communication and marketing directed towards customers. A research study involving 300 students from University Technology Mara (Penang) aimed to explore the factors shaping customers' expectations of food presentation and gauge their perceptions regarding it. The findings revealed that food presentation significantly impacts customers' dining experience, highlighting that factors like color, shape, size, variety, tableware, and arrangement all synergize to whet customer appetites. This knowledge can prove advantageous to food developers, as manipulating these factors can distinctly transform the culinary art and consequently influence customers' food choices. ("Zainol, N., Ariffin, H. F., & Rozali, A. R. A. (2018). *The study of customer perception and expectation toward food presentation*. *Academic Journal of Business and Social Sciences*, 2(1), 1-8.)

In their research, Zellner *et al.* explored whether the arrangement of food on a plate, considering factors like balance and complexity (enhanced by adding color), impacts its visual appeal, similar to how these factors influence the appeal of artworks. They also gauged participants' willingness to sample the food and their preference for it across four presentations: balanced with monochrome, balanced with color, unbalanced with monochrome, and unbalanced with color. While color heightened the appeal of balanced presentations, it had no effect on the appeal of unbalanced ones. Participants were more inclined to try monochrome presentations compared to colored ones, yet neither color nor balance influenced their overall liking of the food's taste. Therefore, while adjusting color and balance might influence the perceived attractiveness of a dish, Zellner *et al.*'s findings suggest that it doesn't necessarily change how much people enjoy

the food's flavor. (“ Zellner, D. A., Lankford, M., Ambrose, L., & Locher, P. (2010). *Art on the plate: Effect of balance and color on attractiveness of, willingness to try and liking for food. Food Quality and Preference, 21(5), 575-578.*)

However, Zellner and her team expanded upon this research in a subsequent study using dishes containing lettuce, carrots, tomatoes, and hummus. In contrast to their previous study where they altered tahini color artificially, they noted that despite participants not indicating distinct attractiveness ratings between the two arrangements (balanced and unbalanced) as before, they found that participants preferred the hummus from the more balanced presentation over the less balanced one. In a second part of the same study, the researchers discovered that a chicken salad placed in a disorderly manner at the center of a lettuce salad was favored more compared to when the chicken salad was shaped as a half sphere in the middle of the salad. As a result, Zellner and her colleagues concluded that the preference of participants was likely influenced by the level of tidiness rather than the degree of food balance on the plate. Interestingly, only animal-based food was considered more contaminated when presented untidily, highlighting that the neatness of food arrangement enhances liking for the food's taste by implying greater care in its preparation.(Zellner, D. A., Siemers, E., Teran, V., Conroy, R., Lankford, M., Agrafiotis, A., ... & Locher, P. (2011). *Neatness counts. How plating affects liking for the taste of food. Appetite, 57(3), 642-648.*) .



a. Balanced presentation of the hummus plate.

b. Unbalanced presentation of the hummus plate.

Selecting the appropriate plate: encompassing size, color, material, and shape collectively:

While past research often modified individual attributes separately (such as plate color or shape), it will become increasingly crucial to concurrently manipulate several plate factors in upcoming studies to observe their combined effects. A recent experiment by Stewart and Goss marks a step in this direction. They had participants sample cheesecake from black or white plates, either round or square. The participants deemed the dessert 20% sweeter when tasted on a round white

plate compared to the other three options. Notably, plateware significantly impacted flavor intensity, showing a 30% increase with the round white plate. This study's findings indicate that using a round white plate might be an effective approach to control calorie intake while meeting our sensory expectations. (“Stewart, P. C., & Goss, E. (2013). *Plate shape and colour interact to influence taste and quality judgments. Flavour, 2, 1-9.*)

Arranging food on a plate involves the visual arrangement of a dish. Beyond the choice of plate ware, the placement of the food itself is crucial. Customers appreciate well-arranged and correctly served food. Particularly in India, customers assess the hygiene, quality, and taste of a dish based solely on its presentation. Visual composition encompasses factors like food color, dish element design, component texture, and their combination, as well as the shape of individual parts and overall spatial arrangement. Even the number of items on the plate, whether odd or even, can influence diners' impressions. Researchers are beginning to explore studies on how element layout affects people's reactions to a dish, revealing various research directions and hypotheses about plating principles.

For instance, Reisfelt et al. conducted a computer-based study to explore the preferences for variations of convenience meals presented visually among a large group of consumers (768 respondents). In their research, they employed a discrete choice experimental approach. This involved displaying different sets of eight photos to participants, each set featuring combinations of meal variations. These variations included aspects like the type of dish (modern or traditional), vegetables (root mix or wok mix), meat (slices or whole pieces of tenderloin pork), presence of sauce, and inclusion of herbs (with or without parsley garnish). Participants were required to indicate their preferred meal, their second choice, and their least favorite option. Of particular relevance to the present study is the comparison between modern and traditional dishes. The findings revealed a significant preference for the modern dish over the traditional one. Furthermore, the preference for the traditional dish was positively associated with age, with older participants favoring it more than their younger counterparts. These results imply that plating preferences may stem from past experiences and a potential comparison with the archetypal appearance of certain dishes. (“Reisfelt, H. H., Gabrielsen, G., Aaslyng, M. D., Bjerre, M. S., & MØLLer, P. E. R. (2009). *Consumer preferences for visually presented meals. Journal of Sensory Studies, 24(2), 182-203.*).

The complexity of a dish is not solely determined by the variety of colors present. It also depends on factors such as the size of the elements, color variation, the number of ingredients, the familiarity of the person with those ingredients, and the combination of elements or products involved. 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 researchers found strong correlations between designed visual properties and perceived complexity. Both vegetable and fruit mixes showed an inverted U-shaped relationship between visual preference and perceived complexity. However, this effect was not observed for

combined fruit and vegetable plates, possibly because they were initially perceived as already complex. 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. (“Mielby, L. H., Kildegaard, H., Gabrielsen, G., Edelenbos, M., & Thybo, A. K. (2012). *Adolescent and adult visual preferences for pictures of fruit and vegetable mixes—Effect of complexity. Food quality and preference*, 26(2), 188-195.) Another study compared the artistic arrangement of elements in a dish to a scenario where the same ingredients were arranged as a common tossed salad or placed side-by-side in a neat but non-artistic manner. Participants completed questionnaires before and after eating the food to assess their expectations, sensory experience, and emotions related to the dish. The artistic presentation inspired by Kandinsky resulted in the food being perceived as more artistic and significantly more liked compared to the other two presentations (with a difference of approximately 36%). While the participants' perceptions of basic tastes were not affected by the plating condition, the food arranged in the art-inspired condition was rated as more than 29% tastier overall. These findings suggest that, assuming the food is not unpalatable, the diner's hedonic and sensory perception is largely influenced by their expectations. (“Michel, C., Velasco, C., Gatti, E., & Spence, C. (2014). *A taste of Kandinsky: Assessing the influence of the artistic visual presentation of food on the dining experience. Flavour*, 3(1), 1-11.)

As per the findings of Namkung *et al.* (2007), 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. (“Namkung, Y., & Jang, S. (2007). *Does food quality really matter in restaurants? Its impact on customer satisfaction and behavioral intentions. Journal of Hospitality & Tourism Research*, 31(3), 387-409.)

So, it can be concluded that the presented dishes must be appealing and appetising.

Food decoration involves arranging selected dishes in an appealing manner to enhance their visual appeal for diners. This presentation significantly influences how people enjoy their meals, with factors like color, components, texture, shape, and arrangement playing a role in creating an aesthetically pleasing combination on the plate.

The focus of food decoration is on the preparation and presentation of dishes to those who are dining. A well-presented and visually appealing dish can positively influence perceptions of its quality. Food decoration is a crucial element in shaping dining satisfaction, starting from the food arrangement at the serving counter, the service style of staff, the restaurant's ambiance, the choice of cutlery and plates, the arrangement of various items on a plate, and the portion size of the food.

Notably, high-end restaurants engage diners' interest through intricate food preparations and visually captivating presentations, among other factors. This aspect is pivotal in creating

enjoyable dining experiences. This study can be valuable for assisting food vendors in attracting customers and establishing a distinct style of food presentation.

While the delectable and nutritious qualities of food largely rely on the expertise and discernment of those serving them, the findings from various research studies discussed in this review clearly indicate that the choice of tableware can significantly enhance diners' well-being and their overall sensory eating encounter. Both the interplay between presentation and cuisine, as well as the integration of these aspects within the broader restaurant ambiance, are subjects that are quickly gaining deeper insights and are undeniably captivating to explore. Further inquiry could delve into comprehending how our focus is influenced by food presentation, gaining more insights into the visual trajectory across a dish, and how that impacts the flavorful journey of the diner. Such investigations could potentially unlock innovative creative processes for chefs. Additionally, a more profound comprehension of the interrelationship between the visual aesthetics of food presentation and fundamental principles of artistic harmony could potentially reveal intriguing new approaches.



Health Hazard associated with Food Decoration

Here are a few problems regarding the food decoration which may eventually lead to disease:

- Food garnishes and decorations are not always necessary and can increase the risk of contamination if not handled properly. Decorative elements are often raw vegetables or fruits that can harbor harmful bacteria.
- The extraction of lead, cadmium, and zinc from ceramic dinnerware decorated with overglaze designs pose health hazards due to these metal accumulation in the body.
- Raw eggs are commonly used for decorations like mayonnaise or Caesar salad dressings. Raw eggs carry the risk of salmonella poisoning if not prepared or stored correctly. They should be avoided by young children, elderly, and those with weak immunity.
- Fresh flowers used for decoration can introduce allergens and pollen into food. This poses a risk for people with plant allergies. Edible flowers need to be properly identified as well to avoid toxicity issues.
- Candles lit on dining tables present a fire hazard and can deposit soot or wax onto served food. This increases chances of accidental ingestion.
- Cloth napkins or tablecloths used for multiple customers without proper laundering can harbor and spread germs.
- Lack of basic hygiene practices while handling or preparing decorative elements like washing hands increases cross-contamination risks. Bacteria from one's hands or surfaces can be introduced into food.
- Overly ornate presentations with multiple perishable garnishes are harder to keep at proper temperature control. This allows pathogens to multiply faster if the "danger zone" temperature is exceeded.

Food decorations may increase food safety risks if they are not handled, stored and presented properly. Basic hygiene practices are important to prevent contamination and spreading of diseases. More research needs to be done to establish the association of potential risks with using food garnishing products.

DISCUSSION

Proper execution of food decoration holds the potential to elevate the dining experience from good to outstanding. The visual presentation of food holds significant importance for both chefs and diners. It goes beyond mere embellishment, playing a psychological role in enhancing the perceived deliciousness of the meal. Precise arrangement and presentation of dishes are appreciated by customers and serve as a reflection of the restaurant's standards. In India, the way food is presented often influences judgments about hygiene, quality, and taste, even before a bite is taken. As a result, the art of food decoration is just as crucial to a dish as its flavor and taste.

IMPORTANCE OF FOOD DECORATION IN INDUSTRIAL ARENA

Food Presentation Impacts Customer Choices

The visual appeal of a dish greatly influences how we perceive it. While our home-cooked meals are usually delicious, people often find restaurant food more enticing due to its appearance. This preconceived judgment is largely based on sight. 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 a social experiment, participants were given identical salads – one simply tossed and the other artfully arranged. The results showed that the garnished salad was considered tastier, and interestingly, many were willing to pay a premium for it. This demonstrates the significant impact that well-presented food can have.

Essential For Food and Restaurant Marketing

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. Leveraging the power of social media is a crucial strategy for restaurants to remain relevant in the eyes of customers. Conversely, if the dishes served are visually captivating, individuals will be inclined to capture and distribute images of them. This practice indirectly promotes both the cuisine and the restaurant, potentially reaching a wide audience. 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.

Food Presentation Communicates the Restaurant Quality

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.

Elevates The Dish

Outstanding food display is achieved by skillfully blending the dish with sauces, garnishes, and sides. These combinations and components not only contribute to the meal but also enhance its flavor and overall quality. Each appetizer and garnish introduces a unique texture and taste, synergizing to amplify the dish's appeal. 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. This is why effective food decoration has become essential in restaurants and other commercial settings. Food presentation goes beyond art; it encompasses a scientific approach to making dishes visually appealing and appetizing.

Chefs at upscale restaurants and luxury hotels now place significant emphasis on the art of garnishing. This practice extends to wedding and event caterers, who use garnishing not only to enhance the visual appeal of food but also to infuse their profession with innovative styles and flavors. By altering the colors, arrangement, and overall design of dishes, they are able to craft exquisite decorations. Equipped with the right culinary tools, they can embellish centerpieces, sculptures, baskets, buffets, and plates, all with the aim of standing out in culinary competitions. While the future holds the promise of technology playing an even larger role in these decorative practices, existing trends such as in vitro meat, sous vide techniques, and the integration of smartphones and tablets into dining experiences necessitate an analysis of the broader societal, political, and economic influences that drive the adoption of these practices across laboratories, restaurant kitchens, supermarkets, and homes.

SUMMARY

Food presentation involves altering, processing, organizing, or adorning dishes to enhance their visual attractiveness. Innovative embellishment and arrangement of food contribute to creating a delightful ambiance. Crafting delightful and playful food arrangements entices both adults and children to relish any meal. Ingeniously simple yet imaginative food design has the power to elevate an ordinary dining experience into an unforgettable one. This art often holds the key to culinary triumph. While good taste is essential, the visual appeal significantly impacts how even mediocre dishes are received. Conversely, even the most delectable cuisine loses its charm if served on a soiled plate.

Essential Food Presentation Tips To Keep In Mind

Here are some food decoration ideas one should be keeping in mind while presenting the food.

The Shape of the Plate

The presentation of food can be influenced by the shape of the plate it's served on. Different forms complement specific types of foods. Angular plates, for instance, lend a smart and modern aesthetic, making them ideal for contemporary desserts or savory dishes. In contrast, round plates create a sense of wholesomeness and are commonly associated with dessert presentations. *The*

Size of the Plate

Plate size is a crucial element in food presentation, carrying significant importance. Careful consideration should be given to the size of the plate. If the plate is too small, the food might appear crowded, whereas an excessively large plate could make the portion seem insufficient. Additionally, the chosen plate size should complement the overall design. For instance, when arranging numerous vertically oriented elements, opting for a moderately smaller plate is advisable. However, it's important to avoid selecting a plate that is excessively small, as a bit of white space along the edges would be necessary.

Colour of the Plate

Various colors have distinct psychological effects on individuals. While certain colors are suitable for plating, others, such as blue, should be avoided due to its association with dieting. White plates are the most favored because they enhance color contrast and offer a neutral foundation. However, when the contrast is appropriately balanced, black plates are seen as modern and robust. *Food Plating Spots*

When plating food, adhere to the clock method. Envision a clock's face as you start arranging the ingredients, as specific types must occupy particular positions. For a conventional plating from the diner's perspective, position the main ingredient (such as chicken or fish) between 3 and 9 on the imaginary clock. Starches like potatoes or fries ought to be placed between 9 and 12, while vegetables belong between 12 and 3.

Proportioning

Balancing food proportions is essential for proper plating. It's not just about visual appeal; correct proportioning also helps manage costs. Each ingredient's portion must be predetermined and upheld during plating. The central focus should be on the main ingredient, with other elements complementing rather than overshadowing it.

Styling

The following food presentation method pertains to the manner of assembling or styling a dish. A crucial principle of this culinary artistry involves achieving a harmonious balance between contrasting elements and a diverse range of components. Overdecorating the dish beyond necessity could potentially mar its appearance or render it unappealing.

Garnishing

The process of garnishing enhances both the texture and flavor of a dish. This culinary technique of food presentation demands precision and careful attention. The garnish's taste and texture contribute to the overall dish texture, requiring a thoughtful selection. It can range from a simple colorful element that, when combined, elevates the dish's appeal, to combinations of diverse fruits, sauces, and seeds that enhance the dish's flavor, acidity, and texture. Whenever feasible, opt for easily recognizable organic garnishes to avoid inconveniences when serving customers.

Employing contrasting colors and height variation can amplify the visual appeal of a plate. The strategic layering or stacking of ingredients adds depth to the dish. Viewing the plate as a canvas is essential in mastering plating artistry. At times, decorators should step back to view the plate as a work of art. While preparing food requires passion, thought, and technique, plating should be executed with a delicate touch, guided by nature. Colors should mirror the seasons,

encompassing contrasting light and dark tones that evoke emotions. Ultimately, simplicity prevails, allowing the ingredients to shine as the focal points. The process of garnishing enhances both the texture and flavor of a dish. This culinary technique of food presentation demands precision and careful attention. The garnish's taste and texture contribute to the overall dish texture, requiring a thoughtful selection. It can range from a simple colorful element that, when combined, elevates the dish's appeal, to combinations of diverse fruits, sauces, and seeds that enhance the dish's flavor, acidity, and texture. Whenever feasible, opt for easily recognizable organic garnishes to avoid inconveniences when serving customers.

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CONCLUSION

The primary aim of undertaking this task is to inspire individuals within the food industry to view eating as a multisensory journey, enabling professionals to enhance their ability to provide positive outcomes for diners and consumers. Instead of focusing solely on the food itself, the emphasis lies on the unique presentation of fine dining, enveloped in the enigmatic and captivating nature of molecular gastronomy.

In the present day, the act of eating encompasses more than just the flavors perceived in our mouths, challenging the conventional notion of flavor as an inherent quality of the food. It becomes a stimulating catalyst for exploring cross-disciplinary considerations about our connection with food, surpassing traditional assumptions of isolated individuals and rational behavior. This prompts a reevaluation of how we conceive taste and flavor, both socially and sensorily. For instance, altering the color of food or beverages can significantly influence the diner's anticipation of the forthcoming taste and flavor.

The inventive approaches adopted by different research teams provide valuable insights to those engaged in studying the science and technology of food. Moreover, these methods are likely to trigger conversations surrounding the ethical and philosophical aspects involved in purposefully manipulating food experiences through sensory cues.

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