



The impact of fruits on the sensory acceptability of yogurt among Generation Z

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ABSTRACT

This study examines the influence of different types of fruits on the sensory acceptability of fruit yogurts among Generation Z. The research was conducted on a sample of 75 participants, employing sensory analysis to evaluate attributes such as taste, aroma, color, texture, and overall sensory acceptability. The results indicate that certain fruits have a statistically significant impact on sensory perception, with strawberries and raspberries receiving the highest scores, while peaches were rated the lowest, particularly in the color category. Aroma and color were identified as key predictors of overall sensory acceptability, demonstrating strong correlations. Differences among participants based on gender and place of residence underscore the importance of demographic characteristics in shaping preferences. These findings provide practical guidance for the food industry, highlighting the need for innovations in product aroma, color, and texture, as well as tailoring offerings to specific demographic groups. The study contributes to understanding the preferences of Generation Z and serves as a foundation for developing products aligned with their sensory and esthetic expectations.

Keywords: fruit yogurt, sensory analysis, Generation Z, sensory acceptability, consumer preferences

ИЗВОД

Ова студија испитује утицај различитих врста воћа на сензорну прихватљивост воћних јогурта код генерације Z. Истраживање је спроведено на узорку од 75 учесника, применом сензорне анализе за процену атрибута као што су укус, арома, боја, текстура и укупна сензорна прихватљивост. Резултати указују да одређене врсте воћа имају статистички значајан утицај на сензорну перцепцију, при чему су јагоде и малине добиле највише оцено, док су брескве добиле најниже оцено, посебно у категорији боје. Арома и боја су идентификоване као кључни предиктори укупне сензорне прихватљивости, показујући снажну корелацију. Разлике међу учесницима на основу пола и места становања истичу значај демографских карактеристика у формирању преференција. Ова открића пружају практичне смернице за прехранбену индустрију, истичући потребу за иновацијама у ароми, боји и текстури производа, као и за прилагођавање понуде специфичним демографским групама. Студија доприноси разумевању преференција генерације Z и служи као основа за развој производа који су усклађени са њиховим сензорним и естетским очекивањима.

Кључне речи: воћни јогурт, сензорна анализа, генерација Z, сензорна прихватљивост, преференције потрошача

1. Introduction

In modern society, dietary trends are undergoing significant shifts, with an increasing number of consumers, particularly younger generations, showing interest in healthy and functional food products (Alae-Carew et al., 2022). Generation Z, encompassing individuals born between the mid-1990s and early 2010s, is characterized by specific dietary preferences focused on healthy, natural foods that meet their needs for nutritionally rich, flavorful, and visually appealing products (Kraak et al., 2006; Gibson et al., 2023). Yogurt, rich in probiotics and other beneficial components, holds a prominent position among such choices, with the addition of fruit further enhancing its attractiveness to consumers (Munteanu-Ichim et al., 2024).

Given these preferences, it is crucial to understand how various types of fruit affect the sensory acceptability of yogurt for Generation Z, which plays a pivotal role in selecting food products. Sensory acceptability encompasses the overall perception of a product through attributes such as taste, aroma, color, and texture, which influence consumer satisfaction and willingness to repurchase (Caracciolo et al., 2020). Different fruits may have varying impacts on the sensory attributes of yogurt, necessitating an exploration of which fruit types best align with Generation Z's sensory preferences (Abbaspour, 2024).

The aim of this paper is to investigate the effect of adding different types of fruit (strawberries, raspberries, peaches, and blueberries) on the sensory acceptability of yogurt among Generation Z. This study is expected to identify the fruit types that enhance the

sensory appeal of yogurt, potentially influencing product development in the food industry targeting younger populations.

2. Literature review

Sensory analysis of food products is a fundamental technique used in the food industry to evaluate attributes that directly influence consumer satisfaction and acceptability. Beyond nutritional value, sensory characteristics such as taste, aroma, color, and texture play a pivotal role in shaping product perception and market acceptance (Sharif et al., 2017). In the competitive fruit yogurt market, particularly when targeting younger populations, these sensory attributes can be decisive for product success. Adding fruit to yogurt not only enhances its nutritional value but also improves its sensory characteristics, making it more appealing to consumers seeking healthy, natural, and flavorful food options (Wajs et al., 2023).

Generation Z increasingly demonstrates interest in products that combine quality with health benefits. They prefer items that are not only nutritious but also visually appealing and satisfying with respect to sensory properties. Yogurt with added fruit offers a blend of taste, texture, and color—attributes that particularly attract Generation Z, as they align with their demand for convenient yet healthy and nutritionally rich meals (Routray et al., 2024). The visual aspect of a product plays a significant role in their selection process, as the appearance and presentation of yogurt can influence initial impressions of quality and freshness (Mantilla et al., 2022).

Fruit as an addition to yogurt contributes to various sensory qualities, depending on its type and specific attributes. For instance, strawberries and raspberries provide sweet and refreshing notes that often appeal to younger consumers, while peaches and blueberries add subtle fruity aromas that enhance the complexity of the sensory experience (Newbold and Koppel, 2018; Mantilla et al., 2022). The texture of the fruit in yogurt is also a key factor, with consumer preferences varying: some enjoy a smooth texture, while others prefer the presence of fruit pieces, which add diversity to the sensory experience (Dhakal et al., 2023). The presence of fruit pieces in yogurt can enhance the perception of naturalness and authenticity, thereby increasing its attractiveness among younger generations (Yotova, 2014).

In addition to taste and texture, fruit color significantly impacts product perception. Bright fruit colors, such as the red of strawberries or the orange hue of peaches, are typically associated with freshness and high quality, which can further contribute to a positive sensory experience (Schifferstein et al., 2019; Veljovic et al., 2019). The aroma of fruit yogurt is another critical attribute, as it can be a decisive factor in the product's sensory acceptability. Aroma contributes to the initial perception of the product and can either increase or decrease the desire for consumption (Krishna, 2012).

Numerous studies emphasize the importance of demographic differences in preferences for sensory attributes of food products (Toma et al., 2008; Bruwer et al., 2011; Sveinsdóttir et al., 2009; Baranda et al., 2024). For Generation Z, sensory acceptability may vary based on individual preferences, as well as cultural and social factors. Some researchers highlight

that Generation Z increasingly prefers natural flavors and simple ingredients, making them inclined toward products with natural fruit additions that do not contain artificial flavors, colors, or preservatives (Meyerding and Ahrens, 2024; Baranda et al., 2024). Moreover, studies suggest that this generation is sensitive to the origin of ingredients and often prefers products sourced sustainably and environmentally responsibly (Meixner et al., 2024; Baranda et al., 2024). The presence of fruit in yogurt can serve as a key quality indicator, giving young consumers the impression of purchasing a healthy and natural product (Cerf et al., 2024).

Beyond sensory analysis, the ethical aspect of food production is particularly important for Generation Z. Many members of generation Z emphasize the importance of sustainability and social responsibility in the production process. Including locally grown fruit or fruit with eco-certifications in yogurts can further enhance the product's positive image in the eyes of young consumers, aligning with their values and environmental standards (Brand et al., 2022). By doing so, manufacturers can target Generation Z with products that are not only appealing to the senses but also environmentally sustainable (Kamenidou et al., 2019; Baranda et al., 2024).

Considering these aspects, sensory analysis of fruit yogurts becomes crucial for better understanding the preferences of Generation Z, enabling manufacturers to create products tailored to their needs and expectations (Mikkola and Colantuono, 2017). Understanding the impact of different types of fruits on yogurt's sensory characteristics can aid in developing strategies for product promotion and placement, increasing its attractiveness and consumer loyalty (Bublitz and Peracchio, 2015). Thus, sensory analysis not only contributes to product quality improvement but also facilitates better positioning in a market characterized by rapidly changing preferences among young consumers (Symmank, 2019; Vukolic et al., 2023).

Hypotheses Based on Literature Review:

H1: Adding different types of fruit significantly affects the sensory acceptability of yogurt among Generation Z.

H1a: There is a statistically significant difference in the sensory acceptability of yogurt depending on the type of fruit used as an addition.

H1b: Strawberries and raspberries will have a greater positive impact on the sensory acceptability of yogurt compared to peaches and blueberries.

H1c: The texture of the fruit in yogurt (smooth vs. with fruit pieces) significantly affects the overall sensory acceptability of the product.

H1d: The visual aspect (color of yogurt with added fruit) has a significant impact on sensory perception among Generation Z.

H1e: Fruit aroma significantly contributes to the sensory acceptability of yogurt.

H2: Significant differences exist in preferences for fruit yogurts among Generation Z based on gender.

H3: Sensory attributes (taste, aroma, color, and texture) positively correlate with the overall satisfaction of Generation Z with fruit yogurts.

3. Methodology

The study was conducted to analyze the impact of different fruit types on the sensory acceptability of yogurt among Generation Z. The research was carried out at the Faculty of Hotel Management and Tourism in Vrnjacka Banja, University of Kragujevac, under controlled conditions that ensured precise and objective evaluation of yogurt's sensory characteristics. The study took place in April 2024, involving 75 students from Generation Z, who were carefully selected as participants due to their alignment with the target population.

Sensory analysis was employed as the primary method, allowing for the evaluation of key sensory attributes of yogurt: taste, aroma, texture, color, and overall sensory acceptability. Each participant had the opportunity to evaluate yogurt samples with the addition of different fruit types: strawberries, raspberries, peaches, and blueberries. The samples were presented in identical containers with coded labels to eliminate potential biases related to branding or packaging. All samples were prepared in a uniform manner to avoid variations unrelated to the evaluated attributes, ensuring consistent temperature, volume, and container shape.

Participants conducted the sensory evaluation in a controlled laboratory environment with appropriate lighting, neutral temperature, and the absence of distracting odors. This setting ensured a standardized approach to sensory analysis. Before the evaluation, participants were briefed on the methodology and the rating scales used. Additionally, they were provided with detailed information about the purpose of the sensory analysis to ensure they fully understood the attributes being assessed. Participants verbally confirmed their understanding of the objectives and procedures of the analysis.

A Likert scale ranging from 1 (very unsatisfactory) to 7 (very satisfactory) was used to evaluate sensory characteristics, with participants rating the yogurt (Table 1) (Amal et al., 2016).

Data collected during the sensory analysis were entered into a database and analyzed using statistical methods. A one-way analysis of variance (ANOVA) was used to evaluate differences in sensory acceptability among various types of fruit additions, while Pearson's correlations and linear regression were employed to determine the relationships between sensory attributes and overall acceptability. All analyses were conducted using SPSS software (version 26).

Table 1.

Attributes for sensory evaluation of yogurt with fruit additions

Attribute	Description	Rating Scale (1–7)
Taste	Intensity and pleasantness of the fruit addition	Very unsatisfactory – Very satisfactory
Aroma	Strength and naturalness of the fruit aroma	Very unsatisfactory – Very satisfactory
Color	Visual appeal and association with the type of fruit	Very unsatisfactory – Very satisfactory
Texture	Smoothness or presence of fruit pieces	Very unsatisfactory – Very satisfactory
Overall Sensory Acceptability	Overall experience of the product	Very unsatisfactory – Very satisfactory

4. Results

Table 2 presents the sociodemographic characteristics of the participants, along with data on their current health status (Zhao et al., 2017; Veljović et al., 2019; Baranda et al., 2024). Prior to the study, participants were briefed on the questionnaire, emphasizing that the survey was anonymous and that the data would be used solely for scientific purposes without disclosing individual participant information. All participants provided consent for participation in the survey.

The analysis of the sociodemographic and health characteristics provides a comprehensive profile of the study participants. The sample of 75 participants consists of 54.67% males (41) and 45.33% females (34), indicating a balanced gender distribution. Most participants belong to the age group of 23–25 years (41.33%), while the least represented groups are 18–20 years and over 25 years. This suggests that the sample predominantly comprises young adults, specifically members of Generation Z.

The majority of participants (72%) are currently pursuing undergraduate studies, 21.33% are enrolled in master's programs, and only 6.67% are doctoral students. Regarding permanent residence, 64% of participants come from urban areas, while 36% are from rural areas, which reflects a higher representation of urban participants. Smoking habits reveal that 56% of participants do not smoke, 32% have been smoking for more than two years, and 12% for less than two years. This prevalence of smokers could potentially influence sensory perception of food, given the known effects of smoking on taste and smell. The general health status of participants is predominantly very good (70.67%) or good (20%). Only 6.67% rated their health as average, while one participant (1.33%) reported poor or very poor health, which does not significantly impact the study's overall findings. Participants reported no allergies to lactose, dairy products, fruit, or gluten, while two individuals mentioned other types of allergies or intolerances.

Table 2.
Sociodemographic characteristics of the participants

		N	%
Gender	Male	41	54.67
	Female	34	45.33
Age	18–20	12	16.00
	21–23	20	26.67
	23–25	31	41.33
	+25	12	16.00
Current level of study	Undergraduate studies	54	72.00
	Master's studies	16	21.33
	PhD	5	6.67
Place of permanent residence	Rural area	27	36.00
	Urban area	48	64.00
Smoking habits	Non-smoker	42	56.00
	Smoking for up to 2 years	9	12.00
	Smoking for more than 2 years	24	32.00
General health status <i>How would you rate your current health condition?</i>	Very good	53	70.67
	Good	15	20.00
	Average	5	6.67
	Poor	1	1.33
	Very poor	1	1.33
Allergies and intolerances <i>Do you have any of the following allergies or intolerances?</i>	Lactose intolerance	0	0
	Allergy to dairy products	0	0
	Allergy to any fruit	0	0
	Gluten intolerance	0	0
	Other allergies/Intolerances	2	100
Chronic diseases <i>Do you have any chronic diseases that might affect your perception of food?</i>	Diabetes	0	0
	Hypertension	1	16.67
	Gastrointestinal issue (e.g., gastritis, irritable bowel syndrome, etc.)	1	16.67
	Respiratory diseases (e.g., asthma)	2	33.33
	Other	2	33.33
Sensory abilities <i>Do you experience difficulties with any of the following senses?</i>	Sense of smell (e.g., reduced sense of smell)	0	0
	Sense of taste (e.g., reduced sensitivity or distortion of taste)	1	50.00
	Other	1	50.00
Current health issues <i>Do you currently have any health issues that might influence your perception of food?</i>	Yes	0	
	No	75	100.00
Specific dietary regimens <i>Do you follow any specific dietary regimen for health-related reasons?</i>	Yes (e.g., reduced sugar diet, gluten-free diet, low-calorie diet, etc.)	14	18.67
	No	61	81.33

In terms of chronic illnesses, the most commonly reported issues were respiratory diseases and gastrointestinal problems, while hypertension and other conditions were minimally represented. However, the majority of participants (97.33%) do not suffer from serious health issues that could significantly affect the results of the sensory analysis. Sensory abilities showed minimal impairments. Only one participant reported reduced taste perception, while no issues with the sense of smell were noted. Additionally, no participants reported current health issues that could affect food perception. Regarding specific dietary regimens, most participants (81.33%) do not follow specialized diets, while 18.67% reported adherence to regimens such as low-calorie or gluten-free diets.

The results of the sensory analysis (Table 3) indicate significant differences in the evaluation of

yogurt with various fruit additions. Strawberry emerged as the most favored addition, with average ratings of M=6.5 for taste, M=6.3 for aroma, M=6.4 for color, M=6.2 for texture, and an overall sensory acceptability of M=6.4. These high scores suggest a universally positive impression among participants, likely due to strawberry's distinctive and appealing aroma, flavor, and visual appeal. Raspberry was also well-received, with an overall sensory acceptability of M=6. Individual ratings for taste, aroma, color, and texture ranged from M=5.9 to M=6.2, slightly lower than those for strawberry. These results indicate a slightly lower preference compared to strawberry but still confirm raspberry as a popular choice among participants.

Table 3.

Average rating for yogurt with the addition of specific fresh fruits

Fruit	Taste	Aroma	Color	Texture	Overall acceptability
Strawberry	M – 6.5	M – 6.3	M – 6.4	M – 6.2	M – 6.4
Raspberry	M – 6.2	M – 6.1	M – 6	M – 5.9	M – 6
Peach	M – 4.6	M – 4.7	M – 3.1	M – 5.6	M – 4.5
Blueberry	M – 6	M – 6.2	M – 6.3	M – 6.1	M – 6.2
M – Average Rating					

Blueberry received similar ratings to raspberry, with an overall sensory acceptability of M=6.2 and average scores between M=6 and M=6.3 for sensory attributes. The high score for color (M=6.3) highlights blueberry as a visually appealing addition, while stable ratings for other attributes confirm its positive sensory impact. In contrast, peach was the least preferred addition, with an overall sensory acceptability of M=4.5. Individual ratings for taste (M=4.6) and aroma (M=4.7) suggest a weaker sensory impression, while color received the lowest score of M=3.1, which may have significantly contributed to its lower overall

acceptability. These results indicate that peach failed to meet participants' expectations, potentially due to poor fruit quality, insufficiently pronounced aroma, or other factors.

The ANOVA results (Table 4) show statistically significant differences between yogurt samples with different types of fruit for all analyzed sensory attributes: taste, aroma, color, texture, and overall sensory acceptability. All p-values are below the standard significance level (0.05), indicating that the type of fruit has a significant impact on participants' perception.

Table 4.

ANOVA Results for sensory attributes of yogurt

	F-stat	p-value
Taste	245.85	0.01
Aroma	293.65	0.03
Color	1477.41	0.00
Texture	41.86	0.01
Overall Acceptability	442.73	0.00

The greatest differences among the samples were observed for color ($F = 1477.41$, $p = 0.00$) and overall sensory acceptability ($F = 442.73$, $p = 0.00$). These findings indicate that the visual impression of the fruit, expressed through its color, is a critical factor shaping participants' perceptions. Overall sensory acceptability, as a combination of all attributes, further confirms that different samples leave distinct overall impressions. For taste ($F = 245.85$, $p = 0.01$) and aroma ($F = 293.65$, $p = 0.03$), differences among the samples were also statistically significant, suggesting that participants recognized variations in flavor and fruit notes between the samples. Texture ($F = 41.86$, $p = 0.01$), although with a slightly lower F-value, exhibited significant differences as well, highlighting the importance of mouthfeel in yogurt evaluation. Overall, the results

confirm that all analyzed attributes—taste, aroma, color, texture, and overall sensory acceptability—are crucial for distinguishing the samples, with color and overall acceptability having the most pronounced impact.

The results of the t-test (Table 5) demonstrate that sociodemographic characteristics, such as gender, place of residence, and smoking habits, have a statistically significant influence on the sensory perception of yogurt with different fruit types. All analyzed attributes—taste, aroma, color, texture, and overall sensory acceptability—exhibited significant differences, with p-values below 0.05. These findings indicate that sensory perception differences are shaped by the individual characteristics of the participants.

Table 5.

T-test results for sensory attributes of yogurt based on sociodemographic factors

	Gender		Place of residence		Smoking habits	
	t-stat	p-value	t-stat	p-value	t-stat	p-value
Taste	1.00359	0.03	0.092158	0.02	-0.11454	0.06
Aroma	0.729085	0.01	0.136719	0.02	-0.11984	0.04
Color	0.679396	0.01	0.031018	0.01	-0.23392	0.02
Texture	0.664303	0.02	0.511784	0.00	-0.10998	0.03
Overall acceptability	0.802876	0.01	0.022998	0.01	0.141158	0.03

Gender has a significant impact on the evaluation of all sensory attributes. The t-statistics and p-values indicate that men and women perceive taste (t-stat = 1.00359, $p = 0.03$), aroma (t-stat = 0.729085, $p = 0.01$), color (t-stat = 0.679396, $p = 0.01$), texture (t-stat =

0.664303, $p = 0.02$), and overall acceptability (t-stat = 0.802876, $p = 0.01$) differently. The greatest differences were observed in taste and overall sensory acceptability, indicating that gender influences the subjective perception of major sensory attributes.

Women, who often exhibit a heightened perception of taste and aroma, may provide stricter evaluations, while men tend to show greater tolerance for sensory variations.

The results indicate that participants from rural and urban areas evaluate sensory characteristics significantly differently, particularly texture (t-stat = 0.511784, $p = 0.00$), color (t-stat = 0.031018, $p = 0.01$), and overall sensory acceptability (t-stat = 0.022998, $p = 0.01$). Differences in texture perception may be related to participants' habits and exposure to various types of food products. For instance, participants from rural areas, who may be more accustomed to homemade dairy products, might exhibit different preferences for yogurt texture compared to urban participants. Visual attributes, such as color, are also significant, suggesting that urban participants may place greater value on the

esthetic aspects of products. Smoking habits showed a significant impact on sensory perception, with the most pronounced differences observed in aroma (t-stat = -0.11984, $p = 0.04$), color (t-stat = -0.23392, $p = 0.02$), and overall sensory acceptability (t-stat = 0.141158, $p = 0.03$). Negative t-statistics for aroma and color indicate that non-smokers rated these attributes higher compared to smokers. This is expected, as smoking can negatively affect the perception of taste and aroma due to reduced sensory sensitivity. Additionally, overall sensory acceptability showed slight but significant differences, further confirming that smokers and non-smokers have differing perceptions.

The results of the correlation analysis (Figure 1) indicate a strong relationship between sensory attributes (taste, aroma, color, and texture) and overall sensory acceptability.

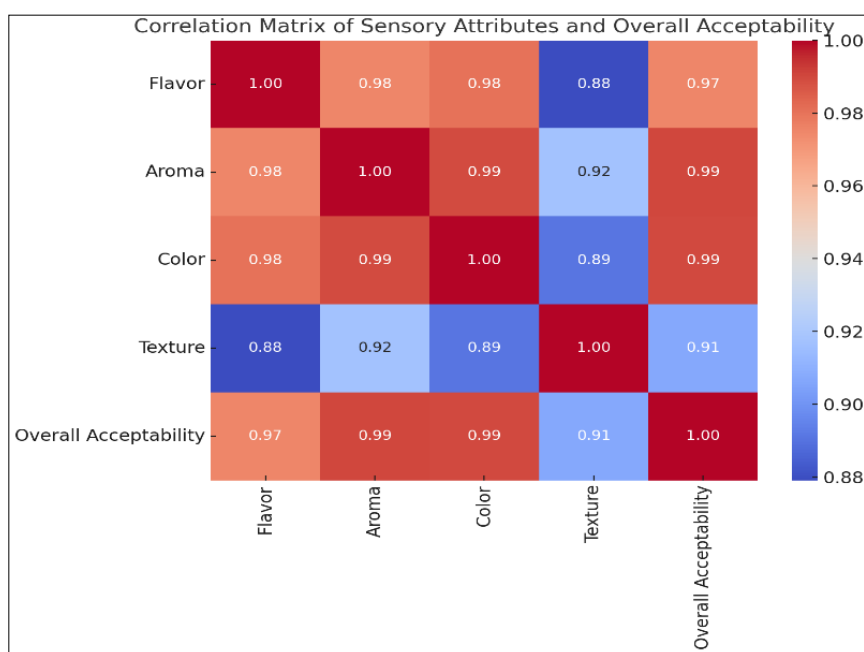


Figure 1. Correlation matrix of sensory attributes and overall acceptability

The correlation matrix shows strong positive relationships between the sensory attributes of yogurt (taste, aroma, color, texture) and their overall sensory acceptability. Correlation coefficients range from 0.88 to 0.99, indicating that all analyzed attributes significantly contribute to the overall product rating, with some attributes exerting a more pronounced influence than others. The results reveal that aroma has the strongest correlation with overall sensory acceptability ($r = 0.99$). This finding suggests that participants perceive the product's aroma as a key factor in their final evaluation. The strong connection between aroma and overall satisfaction highlights the importance of this attribute in the development and improvement of food products.

Color is also strongly correlated with overall sensory acceptability ($r = 0.99$) (Figure 2). The visual appeal of the product often shapes participants' first impressions, which can significantly influence taste perception and overall satisfaction. This confirms that the esthetic aspect of yogurt, such as the natural color of the fruit addition, is crucial for perception. Taste shows a very strong correlation with overall sensory acceptability ($r = 0.97$). As a central attribute of food products, taste plays a pivotal role in shaping consumers' opinions about yogurt quality. It is expected that taste would have a strong relationship with overall satisfaction, as it is the primary aspect of consumers' experience.

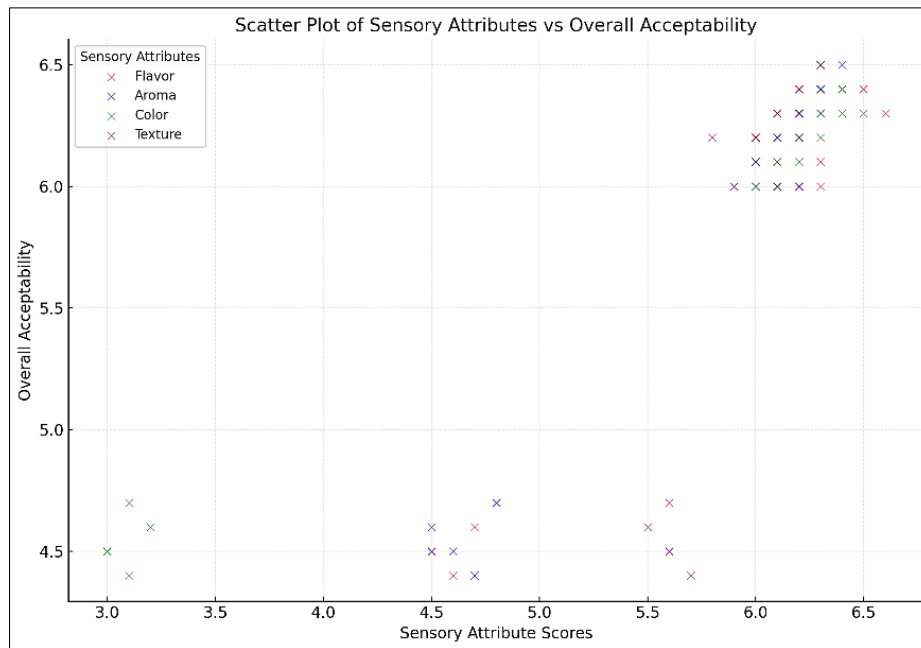


Figure 2. Relationship between sensory attributes and overall sensory acceptability of yogurt

Texture, while showing a slightly weaker correlation ($r = 0.91$), still significantly contributes to the overall impression of the product. The mouthfeel, such as smoothness or the presence of fruit pieces, adds to the complexity of the sensory experience, but it has a smaller impact compared to taste, aroma, and color.

In addition to their relationship with overall sensory acceptability, the attributes exhibit strong intercorrelations. Aroma and color are particularly strongly correlated ($r = 0.99$), suggesting that the visual aspect of the product can directly influence the perception of aroma. This is especially important as color often shapes consumers' expectations about the taste and quality of a product. Taste and aroma are also closely related ($r = 0.98$), reflecting the synergy between these two senses when evaluating food products. On the other hand, color and texture show a slightly weaker correlation ($r = 0.89$), indicating that the visual and tactile aspects of the product are perceived separately, with each sense contributing to the overall experience in distinct ways.

Figure 1 illustrates the relationship between sensory attributes, such as taste, aroma, color, and texture, and the overall sensory acceptability of yogurt. The results clearly indicate a linear relationship, where increases in ratings for individual sensory attributes lead to higher overall acceptability ratings for the product.

The strongest correlation was observed for the attributes of aroma and color, confirming their crucial role in shaping participants' overall perception of the product. Aroma, as an attribute that directly engages the sense of smell and influences taste expectations, significantly contributes to forming a positive impression. Similarly, the product's color, as a visual aspect often leaving the first impression on the consumer, has a substantial impact on overall sensory acceptability. Taste, while slightly less correlated compared to aroma and color, maintains an important role, as expected, given its central importance in food products. Texture, on the other hand, exhibits a somewhat weaker correlation with overall sensory acceptability but still contributes to product perception, especially among participants who focus on the mouthfeel during consumption.

The diagram also shows high ratings in the upper right quadrant, indicating participants' generally positive perception of the analyzed yogurt samples. This distribution emphasizes the importance of enhancing key attributes, such as aroma and color, to maximize consumer satisfaction and improve the overall acceptability of the product. The fulfillment and confirmation of the hypotheses are presented in Table 6.

Table 6.
Confirmation of the hypotheses

Hypotheses		Confirmation
H1	Adding different types of fruit significantly affects the sensory acceptability of yogurt among Generation Z.	The ANOVA analysis results show a statistically significant difference in sensory acceptability among different types of fruit additions (p -values < 0.05 for all sensory attributes). This confirms that the type of fruit significantly influences sensory perception, thereby proving hypothesis H1.
H1a	There is a statistically significant difference in the sensory acceptability of yogurt depending on the type of fruit used as an addition.	Statistically significant p -values in the ANOVA test for sensory attributes confirm this hypothesis. Post-hoc tests further reveal specific differences between samples (e.g., strawberry was rated significantly higher than peach), providing additional evidence that the type of fruit affects sensory acceptability.
H1b	Strawberries and raspberries will have a greater positive impact on the sensory acceptability of yogurt compared to peaches and blueberries.	Post-hoc tests (Tukey) clearly indicate that strawberries and raspberries have significantly higher average scores compared to peaches and blueberries for most sensory attributes. These differences are statistically significant, confirming hypothesis H1b.
H1c	The texture of the fruit in yogurt (smooth vs. with fruit pieces) significantly affects the overall sensory acceptability of the product.	The t-test results for texture show statistically significant differences among various fruit samples, while the correlation analysis confirms the relationship between texture and overall acceptability ($r = 0.91$). This demonstrates that texture significantly contributes to sensory acceptability, thereby proving hypothesis H1c.
H1d	The visual aspect (color of yogurt with added fruit) has a significant impact on sensory perception among Generation Z.	Correlation analysis shows a very strong relationship between color and overall sensory acceptability ($r = 0.99$), while ANOVA results confirm statistically significant differences in color ratings among different samples ($F = 1477.41$, $p < 0.05$). These results validate hypothesis H1d.
H1e	Fruit aroma significantly contributes to the sensory acceptability of yogurt.	The correlation between aroma and overall sensory acceptability is among the strongest ($r = 0.99$), while the ANOVA test shows significant differences in aroma ratings among samples. These results confirm hypothesis H1e.
H2	Significant differences exist in preferences for fruit yogurts among Generation Z based on gender.	The t-test results for gender show statistically significant differences in ratings for most sensory attributes ($p < 0.05$), confirming that gender influences preferences for fruit yogurts. This validates hypothesis H2.
H3	Sensory attributes (taste, aroma, color, and texture) positively correlate with the overall satisfaction of Generation Z with fruit yogurts.	The correlation matrix shows a strong positive relationship between all sensory attributes and overall sensory acceptability (taste: $r = 0.97$, aroma: $r = 0.99$, color: $r = 0.99$, texture: $r = 0.91$). These findings confirm hypothesis H3.

5. Discussion

This study highlights the key factors shaping the sensory perception of fruit yogurts among Generation Z. The results confirm that the addition of different fruit types significantly affects sensory acceptability, with strawberries and raspberries receiving the highest scores compared to peaches and blueberries. These findings support previous research emphasizing the importance of selecting fruit additives to achieve high levels of sensory satisfaction. Generation Z, known for its pronounced preference for innovative and attractive food products, shows a clear inclination toward yogurts that combine intense aroma, appealing color, and distinctive taste.

The results also underline the importance of sensory attributes, such as aroma and color, identified as the strongest predictors of overall sensory acceptability. In line with previous studies, the visual and aromatic aspects of a product play a crucial role in forming a positive impression, while texture, though important, has a slightly lesser impact (Schifferstein et al., 2013; Spence, 2016; Spence et al., 2022). This indicates that Generation Z prioritizes attributes that create an immediate visual and aromatic impression,

consistent with their lifestyle, which is oriented toward quick and sensory-rich experiences.

Interestingly, significant differences in ratings between fruit types were observed, with peach receiving the lowest scores, particularly for color (Zhao et al., 2017). This outcome may be attributed to the lower visual appeal of peaches compared to the more vibrant colors of strawberries and blueberries, indicating that Generation Z places substantial importance on the visual aspects of a product. These findings align with previous studies emphasizing the importance of food esthetics for younger generations. Correlation analysis confirms that taste, aroma, color, and texture are positively associated with overall sensory acceptability, with aroma and color showing the strongest correlation. These attributes not only contribute to satisfaction but also create expectations that directly influence taste perception. These results support previous claims that the synergy between senses significantly impacts the overall product experience.

Generation Z demonstrated a high level of acceptability for fruit yogurts, particularly those with intense aromas and vibrant colors. This consumer group clearly values innovation, quality, and product attractiveness, suggesting that manufacturers should

focus their efforts on enhancing these attributes. Given that Generation Z tends to quickly connect with products that meet their sensory and esthetic criteria, the results of this study provide practical guidance for developing fruit yogurts tailored to the preferences of this target group.

5.1. Theoretical implications of the study

The theoretical implications of this study provide significant contributions to understanding the sensory perception and preferences of Generation Z for fruit yogurts, expanding the existing knowledge base on consumer behavior and the role of sensory attributes in the food industry. The results confirm the theoretical framework emphasizing the importance of sensory attributes, such as aroma, color, taste, and texture, as key factors shaping the perception and acceptability of food products.

The high correlations between sensory attributes and overall sensory acceptability support the thesis of integrated sensory functioning in product evaluation processes. These findings contribute to a deeper understanding of the interdependence of attributes and their synergistic role in creating consumer satisfaction. Furthermore, this study highlights specific characteristics of Generation Z, theoretically linked to their values and preferences. Generation Z exhibits a strong preference for visually appealing products, consistent with theories emphasizing the importance of esthetics in consumer decision-making.

The strong association between color and overall sensory acceptability confirms the visual dominance in product perception among younger generations, further illuminating the significance of visual marketing and branding. Additionally, the results support the theory of multisensory experience, which emphasizes the interaction of different senses in forming an overall impression of a product. The strong correlations of aroma and color with taste and overall sensory acceptability confirm the importance of a holistic approach in food product research.

This study also expands the theoretical discourse on consumer preferences through the analysis of specific fruit additives, such as strawberries and raspberries, which were identified as the most sensory-acceptable. The research also provides a significant contribution to theories on the impact of demographic factors on consumer preferences. Differences in preferences for sensory attributes between men and women, as well as between rural and urban participants, enhance the understanding of socio-demographic variables affecting food perception. These differences support the theoretical concepts of market segmentation based on demographic characteristics. This study significantly contributes to the academic literature on consumer behavior, Generation Z preferences, and the multisensory approach in the food industry. Future theoretical research could focus on developing specific models linking sensory attributes, demographic characteristics, and brand perception to further advance the understanding of consumer preferences.

5.1. Practical implications of the study

The practical implications of this study provide valuable guidelines for the food industry, particularly fruit yogurt manufacturers, in developing products tailored to the preferences of Generation Z. The results highlight key aspects to consider during the design, production, and marketing of fruit yogurts to increase consumer satisfaction and loyalty. Manufacturers should focus on improving aroma and color, as these attributes have been identified as the most critical factors influencing overall sensory acceptability. An intense and natural fruit aroma, combined with visually appealing colors associated with the type of fruit, can significantly enhance product perception. Investing in technologies that enhance the aromatic characteristics of fruit additives, as well as the use of natural colors, can create added value for products targeting Generation Z.

The results show that strawberries and raspberries are the most highly rated fruit additives in terms of acceptability. Manufacturers should prioritize developing products containing these fruit additives, as they meet consumer expectations and preferences. Meanwhile, lower-rated additives, such as peach, require further analysis and improvements in quality and sensory characteristics to increase their acceptability. Although less significant than aroma and color, texture still plays an important role in forming the overall sensory experience. Manufacturers should offer variants with different textures, including smooth yogurts and those with fruit pieces, to meet diverse consumer preferences. This product differentiation could increase market competitiveness.

The study also reveals significant differences in preferences between demographic groups, such as men and women, as well as between rural and urban participants. These findings suggest the need for adapting products to different market segments. Manufacturers could also develop targeted communication strategies for Generation Z, focusing on the visual and sensory attributes of products. Marketing campaigns emphasizing the naturalness, aroma intensity, and visual appeal of fruit yogurts could attract greater attention from this target group. The practical implications of this study provide strategic directions for positioning fruit yogurts in the market, enhancing consumer satisfaction, and achieving competitive advantage, with a focus on sensory innovations and demographically tailored products.

6. Conclusion

This study highlights the key factors shaping sensory perception and acceptability of fruit yogurts among Generation Z, contributing to the understanding of the preferences of this dynamic and specific consumer group. The results confirm that the type of fruit significantly influences sensory acceptability, with strawberries and raspberries recognized as the most sensory-acceptable fruit components, while peach received the lowest scores, particularly due to its visual and aromatic characteristics.

Sensory attributes such as aroma, color, taste, and texture showed strong associations with overall sensory acceptability, with aroma and color identified as the most important predictors of overall satisfaction.

Generation Z, known for its sensitivity to esthetics and experience, demonstrated high acceptability for yogurts combining intense aromas and attractive colors. These findings confirm the importance of a multisensory approach in developing food products, where visual and aromatic aspects play a crucial role in creating a positive impression. The study also showed that socio-demographic characteristics, such as gender and place of residence, influence the perception of sensory attributes. Men and women, as well as rural and urban participants, exhibited different preferences, indicating the need for market segmentation and product adaptation to specific consumer groups.

The practical implications of this study provide valuable guidance for the food industry, suggesting the need for innovations in aroma, color, and texture, as well as a personalized approach to product development. These findings have broader applications in marketing, branding, and strategic positioning of fruit yogurts in the market. This study provides a foundation for further analyses and the development of strategies to better understand and meet the needs of Generation Z. Future research could expand the analysis to different combinations of fruit additives, specific processing technologies, and the impact of additional demographic and psychographic factors, further enhancing the understanding of consumer preferences and the development of food products.

The limitations of this study include the relatively small sample size, which may restrict the generalizability of the results to the broader Generation Z population. The study was conducted in controlled conditions, which do not fully reflect real-world yogurt consumption situations. Furthermore, focusing on only four types of fruit limits insights into preferences for other potential fruit additives. The subjective nature of sensory analysis and reliance on participants' self-assessment may contribute to variations in ratings. Finally, the study exclusively focused on Generation Z, thus limiting comparisons with other demographic groups.

Declaration of competing interests

The authors declare that they have no personal or financial relationships with other individuals or organizations that could inappropriately influence or bias their work, ensuring full compliance with the academic code of conduct.

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