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Sensory Quality and Panel-Based Acceptability of Selected Edible Flowers

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Abstract

The growing interest in functional foods and innovative food products has contributed to increasing attention being paid to edible flowers as ingredients used in gastronomy and food production. Despite their nutritional and health-promoting properties, the market success of edible flowers depends largely on panel-based acceptability, which is strongly influenced by sensory perception and visual quality attributes. The aim of this study is to evaluate the sensory quality and panel-based acceptability of selected edible flower species and to identify the sensory attributes associated with higher acceptability scores. The research material consisted of five edible flowers: acacia (*Robinia pseudoacacia*), pansy (*Viola tricolor*), elderflower (*Sambucus nigra*), white clover (*Trifolium repens*) and daisy (*Bellis perennis*). Sensory evaluation was conducted by a trained panel of ten assessors using a five-point scale. The assessment included overall acceptance, external appearance, colour intensity, taste characteristics, aroma attributes, texture parameters and overall palatability. The results demonstrated significant differences in panel-based acceptability among the flower species that

Key words
edible flowers, sensory quality, visual quality, food quality, trained sensory panel

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were analyzed. Pansy, clover and daisy achieved the highest acceptability scores, while all the flowers received positive ratings for external appearance. The findings indicate that visual attractiveness and colour intensity were the most important factors associated with higher acceptability scores, whereas selected taste attributes played a less significant role in shaping acceptance. The study confirms that flowers characterized by attractive appearance and intense colour received higher acceptability scores from the trained sensory panel. These findings provide useful implications for producers and distributors, highlighting the importance of quality management practices aimed at preserving the visual quality of edible flowers throughout storage, packaging, and distribution processes.

Introduction

In recent years, increasing consumer interest in functional foods, natural products and innovative culinary ingredients has contributed to the growing popularity of edible flowers. Although flowers have been used for centuries in traditional cuisines and herbal medicine, they are currently experiencing renewed interest as components of modern gastronomy, healthy diets and premium food products. Edible flowers are appreciated not only for their decorative value but also for their nutritional and health-promoting properties, including the presence of polyphenols, flavonoids, anthocyanins, vitamins, and antioxidant compounds (Fernandes et al. 2017; Matyjaszczyk, Śmiechowska 2019). Recent reviews further emphasize that edible flowers represent an emerging food category combining nutritional value, bioactive compounds, sensory attractiveness and increasing commercial potential, while highlighting the importance of food safety and appropriate postharvest handling (Carboni et al. 2025). Consequently, edible flowers are increasingly regarded as a promising category of functional foods capable of providing both sensory and physiological benefits.

The edible flower market has expanded considerably in recent years, particularly within the premium gastronomy, catering and functional food sectors. Increasing consumer demand for natural, visually attractive and health-promoting products has stimulated interest in edible flowers among producers, retailers and food service operators. Recent reviews indicate that edible flowers are increasingly perceived not only as decorative ingredients but also as value-added products contributing to product differentiation and consumer experience (Pires et al. 2023).

The contemporary food market is characterized by rapidly changing consumer expectations and increasing demand for products that combine health benefits with attractive sensory characteristics. In this context, edible flowers represent a unique product category in which visual appearance, colour, aroma, texture and flavour play a particularly important role. Unlike many conventional food products, edible flowers are consumed not only because of their nutritional value but also because of their aesthetic qualities, which significantly influence consumers' perceptions and purchasing decisions. Previous studies indicate that consumers frequently evaluate food products on the basis of visual cues before assessing

other sensory attributes, making appearance one of the most influential determinants of food acceptance (Kelley et al. 2001; Śmiechowska 2018).

Recent studies investigating visual food perception further confirm that consumers frequently form quality expectations before tasting a product. Appearance, colour, shape, and freshness may influence not only the decision to purchase but also the perception of flavour and overall product quality. This phenomenon is particularly relevant in the case of edible flowers, where visual attractiveness often constitutes the primary reason for consumer interest and trial (Spence et al. 2016; Nicknezhad et al. 2023).

Consumer acceptance is considered a key factor determining the market success of novel food products. According to contemporary consumer behaviour theories, product acceptance is shaped by a combination of sensory experiences, expectations, individual preferences and perceived quality. Sensory evaluation therefore constitutes an important tool for characterizing sensory quality and identifying attributes associated with panel-based acceptability and potentially relevant for future consumer studies. For edible flowers, attributes such as colour intensity, freshness, aroma profile, texture and taste may substantially affect consumers' willingness to consume and purchase these products. Moreover, because edible flowers remain relatively unfamiliar to many consumers, visual characteristics may play an even greater role than taste-related attributes in shaping first impressions and acceptance.

Studies conducted among consumers evaluating edible flowers indicate that acceptance is influenced by both sensory and psychological factors. In addition to flavour and aroma, consumers frequently consider novelty, perceived naturalness, visual appeal and expected health benefits when assessing edible flower products. Research suggests that products combining attractive appearance with positive sensory experiences are more likely to achieve repeated consumption and market success (Nicknezhad et al. 2023).

Despite the growing scientific interest in edible flowers, existing research has focused primarily on their chemical composition, antioxidant activity, nutritional value, shelf-life characteristics and potential health benefits (Fernandes et al. 2017; Nowicka, Wojdyło 2019; Socha et al. 2021). Considerably less attention has been devoted to consumer perception and the sensory determinants of acceptance. Although several studies suggest that appearance, colour and aroma may influence consumer preferences, comprehensive evaluations linking sensory attributes with overall acceptance remain limited. This research gap justifies further investigation into the sensory quality and panel-based acceptability of edible flowers, particularly those cultivated in Central and Eastern Europe. Understanding the determinants of consumer acceptance is important not only from a scientific perspective but also for producers, distributors, and food service operators. The commercialization of edible flowers requires high sensory quality throughout production, storage, transportation and distribution to be maintained.

Knowledge regarding consumer expectations may therefore support quality management practices and contribute to the development of products better adapted to market demands.

Bearing the above considerations in mind, the aim of the study was to evaluate the sensory quality and panel-based acceptability of selected edible flower species and to identify the sensory attributes associated with higher acceptability scores obtained by a trained sensory panel.

Materials and Methods

Research Design

The study was designed as an empirical sensory evaluation aimed at identifying the determinants of panel-based acceptability of selected edible flowers. The research focused on the assessment of sensory attributes influencing consumer perception and overall product acceptance. Particular attention was paid to visual quality, taste, aroma, texture and colour intensity as factors potentially affecting consumer preferences.

Research Material

The research material consisted of five species of edible flowers commonly used in gastronomy: acacia (*Robinia pseudoacacia*), pansy (*Viola tricolor*), elderflower (*Sambucus nigra*), white clover (*Trifolium repens*) and daisy (*Bellis perennis*). The flowers originated from organic cultivation and were harvested one day before the analyses were performed. Prior to sensory evaluation, all samples were stored at a temperature of 3°C to maintain their freshness and quality. Table 1 presents the characteristics of the edible flower species that underwent analysis.

Table 1. Characteristics of the edible flowers analyzed

Species	Scientific name	Dominant petal colour	Selected culinary applications
Acacia	*Robinia pseudoacacia*	White	Desserts, syrups, salads
Pansy	*Viola tricolor*	Violet-yellow	Decoration of dishes and desserts
Elderflower	*Sambucus nigra*	Cream-white	Beverages, desserts, herbal products
White clover	*Trifolium repens*	White-pink	Salads, teas, decorative purposes
Daisy	*Bellis perennis*	White-yellow	Salads, soups, decorative purposes

Source: own research.

Sensory Evaluation

The sensory assessment was conducted by a trained panel consisting of ten assessors with verified sensory sensitivity. Before the evaluation, the panellists received instructions regarding the assessment procedure and the characteristics of the flower species. The evaluation was performed under controlled laboratory conditions using a five-point scale.

The assessors had previous experience in sensory evaluation and were familiar with descriptive sensory analysis procedures. Before the evaluation, the panel was trained to ensure a consistent understanding of the sensory attributes being evaluated and the scoring criteria. The sensory descriptors were selected on the basis of previous studies on edible flowers (Mlcek, Rop 2011; Fernandes et al. 2017; Demasi et al. 2021) and adapted to the characteristics of the flower species undergoing analysis.

The assessors evaluated both overall acceptability and the selected sensory attributes. Overall acceptability was assessed using a hedonic scale ranging from 1 ("strongly dislike") to 5 ("strongly like"). The intensity of individual sensory characteristics was assessed using a five-point descriptive scale ranging from 1 ("not perceptible") to 5 ("very strongly perceptible").

The sensory evaluation included the assessment of visual, taste, aroma and texture-related attributes, as well as overall panel-based acceptability. For clarity, the sensory descriptors were grouped into five categories: visual, taste, aroma, texture, and overall sensory evaluation. These characteristics are presented in table 2.

Table 2. Evaluated sensory attributes

Category	Attribute	Description
Visual attributes	Appearance	Overall visual attractiveness of the flower
	Colour intensity	Perceived intensity and attractiveness of petal colour
Taste attributes	Sweet taste	Perceived sweetness
	Bitter taste	Perceived bitterness
	Sour taste	Perceived sourness
	Pungent taste	Perceived pungency
	Saltiness	Perceived salty taste
	Herbal flavour	Intensity of herbal flavour notes
	Tea flavour	Intensity of tea-like flavour notes
Aroma attributes	Aroma intensity	Overall aroma intensity
	Floral aroma	Intensity of floral aroma notes
	Tea aroma	Intensity of tea-like aroma notes
Texture attributes	Texture smoothness	Perceived smoothness during consumption
	Firmness	Perceived firmness of flower tissues

Category	Attribute	Description
Overall sensory evaluation	Overall acceptability	Overall panel-based acceptability
	Palatability	Overall sensory attractiveness of the product

Source: own research.

Statistical Analysis

The results were subjected to statistical analysis in order to identify differences among the flower species undergoing evaluation. Descriptive statistics were calculated for all the variables analyzed. The significance of differences between the samples was assessed using non-parametric statistical procedures appropriate for ordinal sensory data. The level of statistical significance was established at $p < 0.05$. Statistical analyses were performed using Statistica 13.3 software (TIBCO Software Inc., Palo Alto, CA, USA).

Since the sensory data were collected using an ordinal five-point scale and the assumptions of normality were not fulfilled, non-parametric statistical methods were employed. Differences among flower species were evaluated using the Kruskal-Wallis test followed by Dunn's post hoc test. Statistical significance was established at $p < 0.05$.

Results

Panel-Based Acceptability of Edible Flowers

The sensory evaluation revealed significant differences in panel-based acceptability among the edible flower species that underwent analysis ($p = 0.015$). The highest acceptance scores were recorded for daisy (*Bellis perennis*), white clover (*Trifolium repens*) and pansy (*Viola tricolor*), with mean scores ranging from 4.67 to 4.80 points. In contrast, acacia (*Robinia pseudoacacia*) and elderflower (*Sambucus nigra*) received significantly lower ratings, averaging approximately 4.0 points. The results of overall acceptability and visual quality assessment are presented in table 3.

Table 3. Overall acceptability score and visual quality attributes of edible flowers

Species	Overall acceptability	Appearance	Colour intensity
Pansy	4.67^{b}	4.78	4.78^{b}
White clover	4.70^{b}	4.40	4.60^{b}
Acacia	4.10^{a}	4.44	3.90^{a}
Elderflower	3.90^{a}	4.70	4.20^{a}
Daisy	4.80^{b}	4.80	5.00^{b}

Different superscript letters indicate significant differences according to Dunn's test ($p < 0.05$).

Source: own research.

The results of the overall acceptability and visual quality assessment are presented in table 3. Species characterized by more intensive and attractive colours generally obtained higher overall acceptability scores. These findings suggest a possible association between visual quality attributes and panel-based acceptability; however, this study does not allow conclusions regarding the relative importance of individual visual attributes in determining overall acceptability.

Visual Quality Assessment

The assessment of external appearance showed no statistically significant differences among the flower species ($p = 0.554$). All flowers received ratings above 4.4 points, indicating a generally high level of visual quality. In contrast, colour intensity significantly differentiated the samples ($p = 0.025$). Daisy, pansy and white clover received the highest colour intensity ratings, whereas acacia and elderflower were accorded significantly lower ones (table 3).

The results indicate that colour intensity differentiated the flower species, whereas external appearance received consistently high ratings across all samples. Although flower species with higher colour intensity generally received higher overall acceptability scores, this study does not provide sufficient evidence to identify colour intensity as a determinant of panel-based acceptability. Further studies involving larger sensory panels and consumer-based evaluations are needed to better understand the relationship between visual quality attributes and product acceptability.

Taste Profile of Edible Flowers

The edible flowers analyzed here exhibited considerable variation in selected taste attributes. Significant differences were observed for sweetness ($p = 0.001$) and herbal flavour intensity ($p = 0.038$), whereas sourness, bitterness, pungency, saltiness and tea flavour did not significantly differ among species. The taste profile of the flowers is presented in table 4.

Table 4. Taste profile of the edible flowers

Species	Sweetness	Herbal flavour	Bitter taste	Sour taste
Pansy	2.00^{a}	2.89^{b}	2.56	1.56
White clover	4.40^{c}	2.10^{a}	1.50	1.20
Acacia	3.20^{b}	3.70^{b}	2.20	1.40
Elderflower	2.80^{b}	2.40^{a}	2.10	1.90
Daisy	2.00^{a}	3.20^{b}	2.10	1.80

Different superscript letters indicate significant differences according to Dunn's test ($p < 0.05$).

Source: own research.

White clover flowers demonstrated the highest perceived sweetness (4.40 points), whereas pansy and daisy flowers received the lowest sweetness ratings (2.00 points). Acacia exhibited the strongest herbal flavour profile (3.70 points), while clover and elderflower were characterized by a significantly lower herbal flavour intensity.

In contrast, pungent and salty tastes were given very low ratings in all the flowers, ranging between 1.0 and 1.6 points and 1.0 and 1.5 points, respectively. These taste attributes therefore contributed only marginally to differences in the sensory profiles of the flower species.

Aroma Characteristics

The results of the aroma assessment are presented in table 5. Aroma-related attributes differentiated the flower species significantly. Statistically significant differences were observed for overall aroma intensity ($p = 0.002$), floral aroma ($p < 0.001$) and tea aroma ($p = 0.004$).

Table 5. Aroma characteristics of the edible flowers

Species	Aroma intensity	Floral aroma	Tea aroma
Pansy	4.33^{b}	4.44^{b}	2.89^{b}
White clover	4.70^{c}	4.90^{b}	2.60^{b}
Acacia	4.80^{c}	5.00^{b}	4.00^{c}
Elderflower	4.30^{b}	4.70^{b}	3.10^{b}
Daisy	3.00^{a}	3.10^{a}	1.80^{a}

Different superscript letters indicate significant differences according to Dunn's test ($p < 0.05$).

Source: own research.

Acacia obtained the highest scores for overall aroma intensity, floral aroma and tea aroma, whereas daisy consistently received the lowest aroma ratings. The results suggest that aroma profiles differ considerably among edible flower species and may contribute to their distinct sensory identities.

Texture Attributes and Overall Sensory Attractiveness

The results of the texture assessment and overall palatability are presented in table 6. Significant differences were found for texture smoothness ($p = 0.015$), whereas firmness and overall palatability did not differ significantly among the flower species analyzed here. In this study, palatability was defined as the overall sensory attractiveness of the edible flowers, reflecting the integrated perception of visual, taste, aroma and texture attributes rather than texture alone.

Table 6. Texture attributes and overall palatability of edible flowers

Species	Smoothness	Firmness	Palatability
Pansy	4.00[b]	4.33	4.11
White clover	3.20[a]	4.30	4.30
Acacia	4.50[b]	4.70	4.50
Elderflower	3.60[a]	4.10	4.10
Daisy	4.10[b]	3.80	3.90

Different superscript letters indicate significant differences according to Dunn's test ($p < 0.05$).

Source: own research.

Acacia had the highest smoothness score (4.50 points), while white clover and elderflower were characterized by a significantly less smooth petal surface. Nevertheless, all the flowers received favourable evaluations regarding firmness and palatability, with mean values ranging from 3.8 to 4.7 points.

Discussion

Visual Quality as the Primary Driver of Panel-Based Acceptability

The results of the study indicate that visual quality appeared to be the sensory attribute most strongly associated with higher panel-based acceptability scores. Species characterized by high colour intensity and attractive appearance, particularly pansy, white clover and daisy, achieved significantly higher acceptance scores than acacia and elderflower. Interestingly, although all the flowers analyzed here received favourable evaluations regarding external appearance, colour intensity emerged as a stronger differentiating factor affecting overall acceptability.

These findings are consistent with previous studies demonstrating that consumers frequently rely on visual cues when evaluating novel food products. According to Kathleen M. Kelley et al. (2001), visual characteristics constitute the first stage of food quality assessment and strongly influence expectations regarding flavour, freshness and overall product quality. Similarly, Luana Fernandes et al. (2017) reported that the aesthetic appeal of edible flowers is one of the principal factors driving consumer interest in this product category. Recent studies further confirm that colour remains one of the most influential sensory attributes affecting food choice and consumer behaviour (Spence et al. 2016). Research conducted among consumers evaluating edible flowers demonstrated that colour, freshness and overall appearance are among the most important factors influencing product acceptance and purchase intention (Nicknezhad et al. 2023).

Although edible flowers remain a niche food product in many European countries, their attractive visual appearance may increase consumers' interest in dishes containing edible flowers and reduce hesitation associated with trying unfamiliar

foods. Therefore, maintaining high visual quality throughout production, storage and distribution should be considered an important element of quality management in the edible flower supply chain. The higher acceptability scores obtained for pansy, white clover and daisy may be associated with their more intensive colour and distinctive floral appearance, which are easily recognized by consumers. Previous studies have shown that products visually resembling familiar edible plants and flowers are generally perceived more favourably than products with less recognizable visual characteristics (Benvenuti, Mazzoncini 2021).

Taste Attributes and Panel-Based Acceptability

The findings revealed significant differences among flower species regarding sweetness, herbal flavour, aroma intensity, floral aroma, tea aroma, colour intensity and texture smoothness. However, not all sensory attributes contributed equally to panel-based acceptability. While colour intensity and visual attractiveness were associated with higher panel-based acceptability scores, attributes such as saltiness, pungency, bitterness and sourness remained at relatively low levels and did not significantly differentiate the flower species.

This observation is consistent with previous studies on edible flowers, which indicate that consumers tend to prioritize easily recognizable sensory characteristics over more subtle flavour nuances (Mlcek, Rop 2011; Nicknezhad et al. 2023). According to Jiri Mlcek and Otakar Rop (2012), edible flowers exhibit highly diverse sensory profiles depending on species, cultivation conditions and maturity stage. Nevertheless, consumers often focus primarily on visually perceived characteristics and dominant flavour impressions rather than complex taste profiles. Similar conclusions were reached by Eleomar de O. Pires Jr. et al. (2023), who demonstrated that colour and aroma attributes exert a stronger influence on the acceptance of edible flowers than individual taste components.

The relatively limited influence of taste-related attributes observed in the present study may reflect the sensory profile of the flower species analyzed and the evaluation patterns of the trained sensory panel. Further consumer-based studies are required to determine whether consumer familiarity with edible flowers influences the role of taste attributes in product acceptance. Unlike conventional fruits or vegetables, edible flowers are often consumed occasionally and primarily for decorative purposes. Consequently, consumers may place greater importance on aesthetic value than on detailed flavour characteristics.

In this study, white clover flowers exhibited the highest sweetness score, whereas acacia flowers were characterized by the most pronounced herbal flavour. Conversely, salty and pungent taste attributes remained at negligible levels in all the flower species. These findings indicate that positive flavour characteristics may contribute to the sensory profile of edible flowers, whereas bitter, salty, and pungent taste attributes were of limited importance in differentiating the flower species analyzed in this study.

The Role of Aroma in Product Differentiation

Aroma-related attributes significantly differentiated the flower species. Acacia and white clover received the highest ratings for aroma intensity, while daisy obtained the lowest scores for both floral and tea-like aroma notes. These findings suggest that aroma contributes to the creation of distinct sensory identities among edible flowers.

Acacia obtained the highest ratings for aroma intensity and floral aroma. However, despite these favourable sensory characteristics, its overall acceptability remained lower than that of pansy, clover and daisy. This observation further supports the conclusion that visual quality may have a stronger impact on panel-based acceptability than aroma-related attributes.

The relationship between sensory complexity and panel-based acceptability has also been highlighted in recent research on edible flowers. Pires et al. (2023) reported that consumers generally prefer products characterized by balanced sensory profiles rather than highly intense or unusual flavour attributes. This may explain why sweetness positively contributed to acceptance in the present study, whereas more specific flavour notes, such as pronounced herbal characteristics, did not correspond to higher panel-based acceptability scores. Such findings suggest that sensory familiarity may be an important factor influencing the acceptance of edible flowers among consumers with limited previous experience.

According to Rop et al. (2012), volatile compounds present in edible flowers contribute not only to flavour perception but also to the overall sensory experience. More recent findings reported by Pires et al. (2023) indicate that floral aroma is among the most appreciated sensory characteristics of edible flowers and may positively influence consumers' willingness to purchase such products. Recent reviews have further confirmed that sensory quality, particularly flavour, aroma and visual appearance, together with food safety considerations, are essential factors supporting the growing interest in edible flowers as functional food ingredients (Chetia et al. 2025).

Although aroma contributes to product differentiation, previous studies indicate that consumers rarely evaluate aroma independently of visual characteristics. Instead, aroma perception is often influenced by expectations generated through appearance and colour. This phenomenon has been described as a multisensory interaction effect, in which visual stimuli modify the perception of flavour and aroma attributes. Consequently, flowers exhibiting attractive visual characteristics may benefit from more favourable overall sensory evaluations even when aroma intensity alone does not differ substantially between products.

Although aroma appeared less influential than visual quality in determining overall acceptance, it remains an important factor contributing to product differentiation. This finding may be particularly relevant for producers targeting premium food markets, where sensory uniqueness often constitutes an important source of competitive advantage.

Managerial Implications for Producers and Retailers

The findings of this study provide several practical implications for producers, distributors and retailers operating in the edible flower market. Since visual quality attributes were identified as the most important sensory attributes associated with higher panel-based acceptability, quality management efforts should focus primarily on maintaining product appearance throughout the supply chain. This observation is particularly important because edible flowers belong to highly perishable horticultural products characterized by a short shelf life and high susceptibility to quality deterioration.

Previous studies investigating postharvest quality of edible flowers indicate that colour fading, petal wilting, moisture loss and mechanical damage are among the most important factors reducing marketability and consumer attractiveness (Demasi et al. 2021). Similarly, Fernandes et al. (2017) emphasized that the commercial success of edible flowers depends not only on their nutritional and functional value but also on the preservation of sensory quality during storage and distribution. Therefore, maintaining visual freshness should be considered a critical element of quality management systems applied within the edible flower supply chain.

Particular attention should be paid to preserving colour intensity, minimizing mechanical damage during transportation and implementing packaging solutions that protect the delicate structure of flower petals. In contrast, texture-related attributes appeared to have a smaller influence on panel-based acceptability, suggesting that resources allocated to quality management should prioritize visual quality characteristics.

The managerial implications derived from the sensory evaluation results are summarized in table 7. The findings indicate that maintaining colour intensity and overall visual appearance should be considered the primary objectives of quality management throughout the edible flower supply chain. In contrast, texture-related attributes appeared to be of secondary importance for panel-based acceptability. Aroma, although less influential than visual characteristics, may contribute to product differentiation and should therefore be emphasized in marketing communication and premium product positioning.

The findings presented in table 7 indicate that effective product quality management in the edible flower sector should focus on preserving sensory characteristics directly associated with product attractiveness, particularly colour intensity and external appearance. Appropriate harvesting, packaging, storage, and distribution practices may contribute to improving the market competitiveness of these products.

Table 7. Managerial implications of sensory evaluation results

Finding	Implication for producers and retailers
Higher colour intensity was associated with higher panel-based acceptability	Protect colour stability during storage and distribution
Attractive appearance was associated with higher panel-based acceptability	Implement packaging solutions minimizing mechanical damage
High visual quality supports product attractiveness	Reduce storage time and maintain freshness
Aroma contributes to product differentiation	Emphasize sensory characteristics in marketing communication
Texture attributes have limited influence on acceptance	Prioritize visual quality control over texture optimization

Source: own research.

It should also be acknowledged that the commercialization of edible flowers depends not only on maintaining high sensory quality but also on compliance with applicable food safety and regulatory requirements. Within the European Union, the legal status of edible flower species may differ depending on their documented history of consumption and intended food use under the Novel Food Regulation (Regulation [EU] 2015/2283…, OJ L 327, 11.12.2015). Therefore, quality management strategies should integrate sensory quality assurance with compliance with relevant regulatory requirements before market introduction.

Overall, the findings indicate that panel-based acceptability of edible flowers was primarily associated with visual quality rather than with complex taste characteristics. These observations highlight the importance of appearance-oriented product quality management and may support producers and distributors in developing commercially attractive edible flower products.

Study Limitations

Several limitations of this study should be acknowledged. Firstly, the sensory evaluation was conducted using a relatively small panel consisting of ten trained assessors, which may limit the generalizability of the findings. Secondly, the study focused on selected edible flower species originating from a specific cultivation system and geographic region. Acceptability scores may vary depending on cultural background, previous experience with edible flowers and dietary habits.

Moreover, the study evaluated sensory acceptance under controlled laboratory conditions, which may not fully reflect real purchasing situations. Future research should therefore include larger consumer panels and investigate the influence of demographic, psychological and behavioural factors on edible flower acceptance. Further studies should also explore practical applications of edible flowers in different food categories, culinary products and gastronomy, in addition to identifying the most effective ways of incorporating edible flowers into everyday diets.

Such research could support product development, consumer education and the commercialization of edible flowers in the functional food market. Consequently, the findings should be interpreted as panel-based sensory evaluations rather than direct evidence of consumer behaviour.

Conclusions

This study has demonstrated that the panel-based acceptability of edible flowers is primarily associated with visual quality attributes. Significant differences in overall acceptability were observed among the flower species that underwent analysis, with pansy (*Viola tricolor*), white clover (*Trifolium repens*) and daisy (*Bellis perennis*) receiving the highest ratings. Among the sensory characteristics that underwent evaluation, colour intensity and visual attractiveness were associated with higher panel-based acceptability scores, whereas taste, aroma, and texture attributes appeared to play a secondary role in differentiating the flower species.

From a practical perspective, the findings highlight the importance of product quality management aimed at preserving the visual characteristics of edible flowers throughout the supply chain. Maintaining colour stability, freshness, and the physical integrity of flower petals during harvesting, storage, packaging, transportation and retail display may improve the sensory attractiveness and market competitiveness of edible flower products. These findings provide useful guidance for producers, distributors and food service operators involved in the commercialization of edible flowers.

The study contributes to the growing body of knowledge on the sensory quality and panel-based acceptability of edible flowers and extends current understanding of the sensory characteristics associated with higher acceptability scores. However, because the study was conducted using a trained sensory panel, the findings should not be interpreted as direct evidence of consumer behaviour or purchasing preferences. Future research should involve larger and more diverse consumer samples under real market conditions to verify whether the relationships observed in panel-based sensory evaluation are reflected in consumer acceptance and purchasing intentions.

References

Benvenuti, S., & Mazzoncini, M. (2021). The biodiversity of edible flowers: Discovering new tastes and new health benefits. *Frontiers in Plant Science*, *11*, 569499, https://doi.org/10.3389/fpls.2020.569499.

Carboni, A.D., Di Renzo, T., Nazzaro, S., Marena, P., Puppo, M.C., & Reale, A. (2025). *A Comprehensive Review of Edible Flowers with a Focus on Microbiological,*

Nutritional, and Potential Health Aspects. Foods, *14*(10), 1719, https://doi.org/10.3390/foods14101719.

Chetia, I., Vijayakumar, A., & Badwaik, L.S. (2025). *Edible flowers' flavor, safety and their utilization as functional ingredients: A review*. *Journal of Food Science and Technology*, *62*(1), pp. 11–23, https://doi.org/10.1007/s13197-024-06071-4.

Demasi, S., Mellano, M.G., Falla, N.M., Caser, M., & Scariot, V. (2021). Sensory profile, shelf life, and dynamics of bioactive compounds during cold storage of 17 edible flowers. *Horticulturae*, *7*(7), 166, https://doi.org/10.3390/horticulturae7070166.

Fernandes, L., Casal, S., Pereira, J.A., Saraiva, J.A., & Ramalhosa, E. (2017). Edible flowers: A review of the nutritional, antioxidant, antimicrobial properties and effects on human health. *Journal of Food Composition and Analysis*, *60*, pp. 38–50, https://doi.org/10.1016/j.jfca.2017.03.017.

Kelley, K.M., Behe, B.K., Biernbaum, J.A., & Poff, K.L. (2001). Consumer preference for edible-flower color, container size, and price. *HortScience*, *36*(4), pp. 801–804.

Matyjaszczyk, E., & Śmiechowska, M. (2019). Edible flowers. Benefits and risks pertaining to their consumption. *Trends in Food Science & Technology*, *91*, pp. 670–674, https://doi.org/10.1016/j.tifs.2019.07.017.

Mlcek, J., & Rop, O. (2011). Fresh edible flowers of ornamental plants – A new source of nutraceutical foods. *Trends in Food Science & Technology*, *22*(10), pp. 561–569, https://doi.org/10.1016/j.tifs.2011.04.006.

Nicknezhad, S., Hashemabadi, D., Allahyari, M.S., Marzban, S., Hassen, T.B., & Surujlal, J. (2023). Sensorial analysis of factors influencing consumers' perceptions toward the consumption of edible flowers in Iran. *Journal of Agriculture and Food Research*, *12*, 100580, https://doi.org/10.1016/j.jafr.2023.100580.

Nowicka, P., & Wojdyło, A. (2019). Anti-hyperglycemic and anticholinergic effects of natural antioxidant contents in edible flowers. *Antioxidants*, *8*(8), 308, https://doi.org/10.3390/antiox8080308.

Pires Jr, E. de O., Di Gioia, F., Rouphael, Y., García-Caparrós, P., Tzortzakis, N., Ferreira, I.C.F.R., Barros, L., Petropoulos, S.A. & Caleja, C. (2023). Edible flowers as an emerging horticultural product: A review on sensorial properties, mineral and aroma profile. *Trends in Food Science & Technology*, *137*, pp. 31–54, https://doi.org/10.1016/j.tifs.2023.05.007.

Regulation (Eu) 2015/2283 Of The European Parliament and of The Council of 25 November 2015 on novel foods, amending Regulation (EU) No 1169/2011 of the European Parliament and of the Council and repealing Regulation (EC) No 258/97 of the European Parliament and of the Council and Commission Regulation (EC) No 1852/2001 (OJ L 327/1, 11.12.2015).

Rop, O., Mlcek, J., Jurikova, T., Neugebauerova, J., & Vabkova, J. (2012). Edible flowers – A new promising source of mineral elements in human nutrition. *Molecules*, *17*(6), pp. 6672–6683, https://doi.org/10.3390/molecules17066672.

Socha, R., Kałwik, J., & Juszczak, L. (2021). Phenolic profile and antioxidant activity of the selected edible flowers grown in Poland. *Acta Universitatis Cibiniensis Series E: Food Technology*, *25*(2), pp. 185–200.

Spence, C., Okajima, K., Cheok, A.D., Petit, O., & Michel, C. (2016). Eating with our eyes: From visual hunger to digital satiation. *Brain and Cognition*, *110*, pp. 53–63, http://dx.doi.org/10.1016/j.bandc.2015.08.006.

Śmiechowska, M. (2018). Czynniki wpływające na atrakcyjność kwiatów jadalnych. *Nauki Inżynierskie i Technologie / Engineering Sciences And Technology*, *1*(28), pp. 42–49.

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Ethical review and approval were not required for this study because the research involved sensory evaluation of food products by adult participants and did not include medical interventions or the collection of sensitive personal data.

Informed Consent Statement

Informed consent was obtained from all participants involved in the sensory evaluation.

Data Availability Statement

The data presented in this study are available from the corresponding author upon reasonable request.

Declaration of Generative AI Use

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Conflict of Interest

The authors declare no conflict of interest.