Journal homepage: www.fia.usv.ro/fiajournal
Journal of Faculty of Food Engineering,
Ştefan cel Mare University of Suceava, Romania
Volume XXV, Issue 2 - 2026, pag. 150 - 157

AROMATIC NOTES AND SENSORY PROFILE OF COFFEE PROCESSED IN SUCEAVA, ROMANIA

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Received 02 February 2026, accepted 30 June 2026

Abstract: *Coffee is one of the most widely consumed beverages worldwide, appreciated for its stimulating effect and the complexity of its sensory experience. In an increasingly quality- and transparency-oriented market, sensory evaluation represents an essential tool for product differentiation and for strengthening consumer trust. This study analyzes four roasted coffee varieties processed in Suceava, Romania - two commercial blends (C1 - commercial blend (Arabica (2 varieties) + Robusta), C2 - commercial blend (Arabica 40% / Robusta 60%)) and two specialty coffees (C3 - specialty Guatemala (100% Arabica), C4 - specialty El Salvador (100% Arabica)) - using a standardized cupping protocol focused on aroma, body, acidity, sweetness, aftertaste, and balance. Additionally, a consumer survey explored preferences regarding origin, brewing methods, and health-related attitudes. The results showed high sensory scores for all samples, highlighting the expression of complex aromatic profiles. C3 - specialty Guatemala (100% Arabica) and C4 - specialty El Salvador (100% Arabica) stood out due to their intense aroma, sweetness, and persistent aftertaste, while C2 - commercial blend (Arabica 40% / Robusta 60%) exhibited a well-balanced profile. C1 - commercial blend (Arabica (2 varieties) + Robusta) recorded lower performance in preparation, suggesting limitations in its aromatic profile. Panel evaluations strongly correlated with producers' descriptions, confirming the credibility of brand communication. Consumer responses indicate a growing interest in specialty coffee and a willingness to pay premium prices for authentic, high-quality products. The study thus highlights the competitive potential of coffees processed in Suceava and the importance of regional identity in differentiation within the specialty coffee market.*

Keywords: *aromatic profile, coffee quality assessment, commercial coffee, consumer perception, sensory attributes, specialty coffee*

1. Introduction

Coffee is one of the most widely consumed beverages worldwide, appreciated not only for its stimulating effect but also for the complexity and diversity of its sensory characteristics. In recent years, consumer interest in specialty coffee products and their traceability has increased significantly, directing the coffee industry toward detailed evaluation of the aromatic and sensory profile as a primary criterion for product differentiation and value enhancement [1, 2, 3]. In this context, 100% *Coffea arabica* (*Arabica*) coffee is recognized for its superior quality and aromatic complexity, being frequently associated with the specialty segment, while commercial blends that include *Coffea canephora* (*Robusta*) are mainly oriented toward achieving a more intense taste, higher caffeine content, and economic stability. Thus, the comparative analysis of

DOI: https://doi.org/10.4316/fens.2026.15

Arabica coffee samples and those derived from commercial blends becomes essential for highlighting differences in quality and sensory attributes. Within this framework, sensory analysis represents a key tool for quality control, optimization of technological processes, and meeting consumer expectations [4]. The aromatic profile of coffee results from complex interactions between botanical origin, variety, pedoclimatic conditions, post-harvest processing methods, roasting parameters, and brewing techniques [1, 5, 6]. During the roasting process, green coffee beans undergo profound physicochemical transformations, such as Maillard reactions, caramelization, and the degradation of chlorogenic acids - processes that lead to the formation of a complex aromatic profile responsible for coffee's flavor and taste [1, 2, 7]. These compounds determine the sensory identity of the final product, expressed through attributes such as aroma, acidity, body, sweetness, and aftertaste [4, 8, 9]. Standardized sensory analysis provides an objective and reproducible approach for characterizing coffee quality. Protocols developed by international organizations such as the Specialty Coffee Association and the Coffee Quality Institute enable consistent comparison of samples and the classification of coffee into commercial or specialty categories [10]. Although numerous studies have focused on coffee originating from producing countries [11, 12], there is a limited number of studies addressing the sensory characteristics of coffee processed in non-producing regions, where roasting and blend formulation play a decisive role in defining the final aromatic profile [3, 6]. Recent research highlights that roasting style and the control of technological parameters significantly influence the expression of aromatic notes and overall product acceptability [5, 7].

In Romania, coffee consumption has a long-standing tradition, and regional processing centers increasingly contribute to the diversification of the market and the improvement of product quality [7, 13]. The city of Suceava represents a relevant example, providing an appropriate framework for evaluating the impact of local processing practices on coffee aroma and sensory profile. Therefore, the aim of this study is to comparatively analyze the aromatic notes and sensory profile of 100% *Arabica* coffee and commercial blends containing Robusta, processed in Suceava, Romania, using standardized sensory evaluation methods. The obtained results contribute to the objective characterization of regionally processed coffee and to highlighting qualitative differences between the specialty and commercial segments, supporting the development of products with a distinct aromatic profile and high added value, adapted to current consumer demands [1, 2, 4, 5, 7, 10].

2. Materials and methods

The study evaluated the sensory profile of coffee, focusing on aroma, body, acidity, aftertaste, and balance. For this purpose, a preliminary survey on consumer preferences was conducted. The questionnaire, administered to 104 respondents (aged 18 - 65, from both urban and rural areas) between October and December 2024, collected data on the type of coffee consumed, consumption frequency, brewing method, health perceptions, personal motivations, and the relationship with brands and professional sensory analysis. The analyzed samples were purchased from a local producer in Suceava, Romania, recognized for artisanal roasting and high-quality standards [14]. Four representative coffee varieties were selected, including two commercial blends containing *Robusta* and two specialty coffees of pure origin, 100% *Arabica*, as shown in Table 1.

Table 1.

Coffee sample scoring and producer description [14]

Parameter	*C1* - commercial blend	*C2* - commercial blend	*C3* - specialty Guatemala	*C4* - specialty El Salvador
Country of origin	Not specified (blend)	Nespecificată (blend) Not specified (blend)	Guatemala (Central America)	El Salvador (Central America)
Species/Cultivar	*Arabica* (2 varieties varieties) + *Robusta*	40% *Arabica* / 60% *Robusta*	100% *Arabica*	100% *Arabica*
Processing method	Not specified	Not specified	Washed	Washed
Harvest year	Not specified	Not specified	Not specified	Not specified
A Altitude	Not specified	Not specified	>1600 m	Not specified

Sensory evaluation was performed using the official SCA cupping protocol (100-point scale) [10]. The same evaluation framework was applied to all samples, including *Arabica* and *Arabica – Robusta* blends, to ensure methodological consistency and comparability of results. Differences in sensory expressions associated with *Robusta* content were interpreted within the standard SCA descriptors without modifying the scoring system. Each sample consisted of 8 g of freshly ground coffee (grinding size of 0.8 - 1.5 mm) and was prepared with 150 mL of filtered water at 92 – 96 °C, with an infusion time of 4 minutes. The tasting was conducted in a neutral room with a constant ambient temperature and no external odors, and the evaluation was performed by a panel of five trained tasters using a scoring method for each sensory attribute. The samples were presented in identical containers and coded numerically, with each analysis carried out in two replicates.
All sensory scores were calculated exclusively using the official 100-point SCA scale. Any alternative preliminary evaluation systems were excluded and are not included in the final analysis.

3. Results and discussion

The market study conducted on a sample of 104 respondents provided a clear overview of the demographic characteristics and consumption preferences among participants. The distribution of the place of origin was balanced, with 51% of respondents coming from rural areas and 49% from urban areas, allowing for a relevant comparative analysis between these segments. Regarding gender, the majority of respondents (73.1%) were female, suggesting a higher level of interest from the female population in the study topic. The 16–22 age group was the most represented (36.5%), indicating a strong interest among young people in coffee consumption. A significant proportion, over 90% of respondents, consume coffee, with the main preference being for coffees originating from South America (50%). These coffees are characterized by a sensory profile defined by notes of citrus, red fruits, floral nuances, caramel, chocolate, and nuts, associated with medium to high acidity, perceptible sweetness, and a medium body, reflecting consumers' appreciation for aromatic complexity, profile clarity, and gustatory balance. The preferred preparation method is espresso (54.8%), indicating a preference for concentrated beverages with an intense sensory profile.
Regarding desired sensory characteristics, respondents perceived flavor as intense (36%), acidity as moderate to high (36.2%), body as medium to full (40%), and aftertaste as pleasant and persistent (38.1%). The appearance of coffee was rated as excellent by 40% of participants, while aroma/aromatic intensity was considered strong and pleasant,

contributing to the overall sensory experience. The preferred aromatic profile included sweet and pronounced notes, with chocolate (57.7%) and caramel (34.6%) being dominant, while floral and fruity notes were less appreciated.

Overall, the results suggest a young, predominantly female consumer profile with clearly defined preferences for high-quality coffees characterized by moderate flavor and acidity, a medium body, and espresso-based preparation. These data allow producers in Suceava municipality to develop targeted strategies both in terms of product selection and adjustment of the sensory profile - including aroma, taste, aftertaste, and body - in order to better meet market expectations and maximize consumer satisfaction in this region.

The differences and similarities between the coffee samples analyzed from the local producer in Suceava, Romania, can be clearly observed in the visual representation of the total sensory scores (Fig. 1), which allows for a rapid comparison of key attributes - aroma, body, acidity, sweetness, aftertaste, and balance - for each prepared coffee. *Arabica* coffee, evaluated according to the SCA standard, is distinguished by floral and fruity aromas, clear acidity, and a balanced and complex profile, whereas *Robusta* coffee or blends rich in *Robusta* exhibit more woody and bitter notes, a denser body, lower acidity, and a balance oriented mainly toward intensity and persistence.

C2 - commercial blend (40% *Arabica* + 60% *Robusta*) stood out through a refined sensory profile, with well-defined aromas, persistent aftertaste, and excellent overall balance. The total score for the prepared coffee was 88.0 ± 0.58, highlighting the consistency of its aromatic characteristics. Minor interactions between sweetness and aromatic clarity among different *Arabica* and *Robusta* coffee species were observed, explainable by chemical interactions occurring during the brewing process.

C3 - specialty Guatemala (100% *Arabica*), originating from a single origin, achieved a score of 98.0 ± 1.16, highlighting a strong, well-balanced sensory profile with remarkable aromatic clarity. This score confirms the authenticity and superior quality of the product, as well as the rigorous control of the process, from bean selection to final extraction.

C4 - specialty El Salvador (100% *Arabica*) was distinguished by a floral-fruity aroma, medium body, subtle acidity, and a vibrant aftertaste. The score of 95.8 ± 0.81 indicates a positive intensification of aromatic characteristics during extraction, suggesting an appropriate roasting level in relation to the obtained sensory profile and an origin that responds very well to the brewing process.

C1 – commercial blend (*Arabica* (2 varieties) + *Robusta*) recorded the lowest overall sensory score among the analyzed samples, as shown in Fig. 1. This is mainly due to the less complex nature of commercial coffee and the interactions between different coffee species and bean origins during roasting and brewing. The result is a more modest profile in terms of aromatic clarity, balance, and complexity compared to the specialty *Arabica* coffees (*C3* - specialty Guatemala (100% *Arabica*) and *C4* - specialty El Salvador (100% *Arabica*)), which achieved higher scores due to their single-origin nature.

One-way ANOVA revealed statistically significant differences among groups ($F = 166.4$, $p<0.001$). Tukey's post-hoc test indicated that group *C3* - specialty Guatemala (100% *Arabica*) differed significantly from all other groups, whereas no significant differences were observed between *C1* - commercial blend (*Arabica* (2 varieties) + *Robusta*) and *C2* - commercial blend (40% *Arabica* + 60% *Robusta*) ($p> 0.05$). The roasting uniformity was not evaluated using instrumental color measurements (CIELAB *L**, a*, b* parameters). Therefore, conclusions

regarding roasting consistency are based solely on sensory evaluation and should be interpreted with caution. In conclusion, all four coffee varieties exhibit well-defined aromatic profiles, sensory balance, and a persistent aftertaste, being high-quality products appreciated by informed consumers.

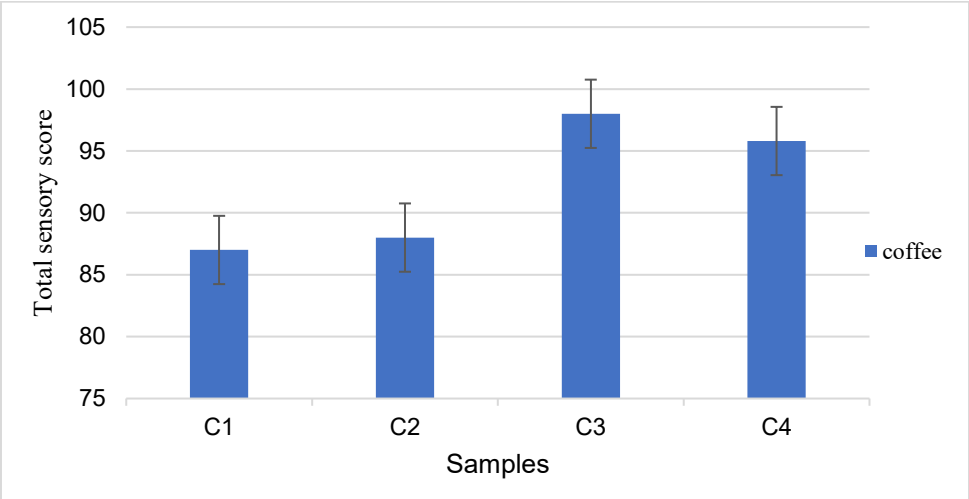

Fig. 1. Comparison of the total sensory scores of the analyzed coffee samples: C1 – commercial blend (*Arabica* (2 varieties) + *Robusta*), C2 – commercial blend (40% *Arabica* + 60% *Robusta*), C3 – specialty Guatemala coffee (100% *Arabica*), and C4 – specialty El Salvador coffee (100% Arabica)

Figure 2 illustrates the comparative sensory profile of samples *C1* - *C4*, analyzed across the fundamental cupping evaluation axes: aroma, flavor, aftertaste, acidity, body, balance/sweetness, defects, and uniformity. The distribution of the polygons indicates a relatively close overall scoring between samples; however, it also reveals clear differences in the expression of key sensory attributes. Based on the obtained values, significant sensory differences are observed among the analyzed samples, reflecting both variations in the intensity of individual attributes and trade-offs between them.

Regarding **aroma**, samples *C3* - specialty Guatemala (100% *Arabica*) and *C4* - specialty El Salvador (100% *Arabica*) exhibit the highest aromatic expressiveness, suggesting superior complexity and a well-developed aromatic profile during preparation.

Sample *C2* - commercial blend (40% *Arabica* + 60% *Robusta*) remains within a good qualitative range, although slightly lower, while *C1* - commercial blend (*Arabica* (2 varieties) + *Robusta*) indicates a reduced aromatic intensity.

Regarding the flavor attribute, more pronounced differences are observed among the samples. *C3* - specialty Guatemala (100% *Arabica*) and *C4* - specialty El Salvador (100% *Arabica*) achieve the maximum score, indicating a complex, well-defined, and intense gustatory profile. *C2* - commercial blend (40% *Arabica* + 60% *Robusta*) shows a good level of gustatory intensity, whereas *C1* - commercial blend (*Arabica* (2 varieties) + *Robusta*) exhibits a lower sensory expressiveness.

Regarding the aftertaste attribute, samples *C2* - commercial blend (40% *Arabica* + 60% *Robusta*), *C3* - specialty Guatemala (100% *Arabica*), and *C4* - specialty El Salvador (100% *Arabica*) exhibit high persistence and superior quality of residual sensations, characteristic of high-quality coffees. In contrast, *C1* - commercial blend (*Arabica* (2 varieties) + *Robusta*) presents a shorter and less persistent aftertaste.

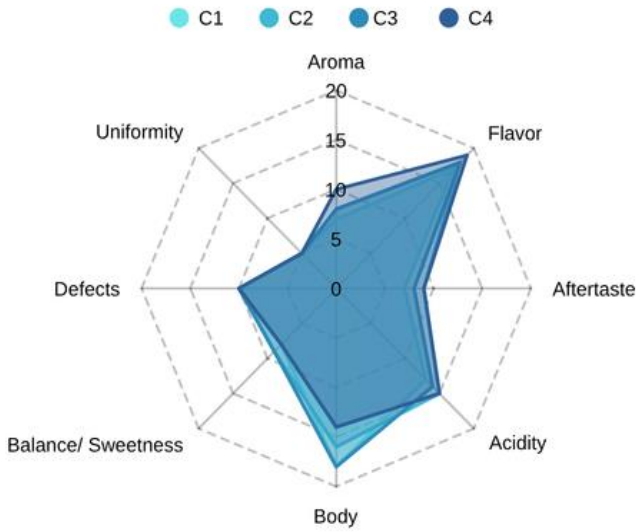

Fig. 2. Comparative sensory profile of the coffee samples analyzed in the study: C1 – commercial blend (*Arabica* (2 varieties) + *Robusta*), C2 – commercial blend (40% *Arabica* + 60% *Robusta*), C3 – specialty Guatemala coffee (100% *Arabica*), and C4 – specialty El Salvador coffee (100% *Arabica*)

Regarding acidity, *C2* - commercial blend (40% *Arabica* + 60% *Robusta*) and *C4* - specialty El Salvador (100% *Arabica*) exhibit a more pronounced acidity, associated with sensory freshness and liveliness, while *C1* - commercial blend (*Arabica* (2 varieties) + *Robusta*) and *C3* - specialty Guatemala (100% *Arabica*) shows moderate values, indicating a more balanced integration but a less expressive expression of this attribute.

At the level of body, *C1* - commercial blend (*Arabica* (2 varieties) + *Robusta*) and *C3* - specialty Guatemala (100% *Arabica*) presents a denser texture and a more pronounced tactile sensation, whereas *C2* - commercial blend (40% *Arabica* + 60% *Robusta*) is slightly lighter, and *C4* - specialty El Salvador (100% *Arabica*) exhibits the lightest body, suggesting a more delicate beverage structure. The balance/sweetness attribute indicates that samples *C2* - commercial blend (40% *Arabica* + 60% *Robusta*) and *C3* - specialty Guatemala (100% *Arabica*) exhibits the highest level of sensory balance, reflecting an optimal harmonization between acidity, sweetness, and body. In contrast, *C1* - commercial blend (*Arabica* (2 varieties) + *Robusta*) and *C4* - specialty El Salvador (100% *Arabica*) show slight imbalances, suggesting a less uniform integration of sensory components. The attributes, defects, and uniformity present constant values across all samples, indicating the absence of sensory defects and a high level of consistency in the evaluation.

Overall, the results highlight that *C3* - specialty Guatemala (100% *Arabica*) and *C4* - specialty El Salvador (100% *Arabica*) stand out for superior sensory performance, particularly due to high flavor intensity and pronounced aromatic expressiveness. However, *C3* - specialty Guatemala (100% *Arabica*) demonstrates an additional advantage through better balance and a more structured body, which confer a more complete sensory complexity. In contrast, *C4* - specialty El Salvador (100% *Arabica*), although highly performant in terms of aroma, flavor, and aftertaste, is slightly limited by its reduced body and lower balance, resulting in a lighter and less structured profile.

Sample *C2* - commercial blend (40% *Arabica* + 60% *Robusta*) is characterized by an overall balanced profile, without pronounced sensory extremes, but also without maximum values for key attributes. Meanwhile, *C1* - commercial blend (*Arabica* (2 varieties) + *Robusta*) shows lower performance across most parameters, with the exception of body, suggesting a less complex sensory experience.

Thus, overall sensory performance is predominantly determined by the interaction between flavor, aroma, and balance, while body contributes to structural perception but cannot compensate for a lack of aromatic and gustatory complexity.

4. Conclusion

The analysis of coffee consumption behavior and sensory profile in Romania shows an increasing appreciation for specialty coffee and products with distinct aromas.

The evaluation of the four coffee varieties (*C1*, *C2* - commercial coffee; *C3*, *C4* - specialty coffee) highlights:

1. **Consistent quality:** all samples achieved high scores in brewed coffee evaluation, suggesting adequate technological control of the roasting process.
2. **Alignment with producers:** the panel's perception confirms the declared aromatic profiles and supports brand transparency.
3. **Dominant attributes:** aromatic complexity and clarity, aftertaste persistence, and overall balance, with a more pronounced expression in specialty coffees.
4. **Minimal individual variations:** differences in sweetness, acidity, and bitterness are reduced and do not affect the overall quality assessment.
5. **Expression in brewed coffee:** infusion highlights aromas and organoleptic characteristics more clearly, enhancing the sensory profile of each variety.

These results emphasize the essential role of quality and transparency in product appreciation and highlight the potential of specialty coffee to provide a unique sensory experience, guiding both producers and consumers in purchasing decisions and market differentiation.

5. Acknowledgments

The authors thank the staff of the sensory laboratory at the AgroBioTech Research Centre, Slovak University of Agriculture in Nitra, Slovak Republic for their support during the research (14/11/2024–30/11/2024) within the framework of the mobility project for researchers, project code *PN-IV-P2-2.2-MC-2024-0087*, and for their valuable expertise, which was essential for the completion of the study.

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