Scientific Bulletin. Series F. Biotechnologies, Vol. XXX, No. 1, 2026
ISSN 2285-1364, CD-ROM ISSN 2285-5521, ISSN Online 2285-1372, ISSN-L 2285-1364

HIGHLIGHTING THE INFLUENCE OF BROCCOLI MICROGREENS (*Brassica oleracea* var. *italica*) ADDED TO COW'S WHITE CHEESE (TELEMEA) ON THE PURCHASING PREFERENCES OF THE FINAL CONSUMER

Oana LIVADARIU[1], Laura-Maria VALS[1], Paulina VALS[2]

[1]University of Agronomic Sciences and Veterinary Medicine of Bucharest, Faculty of Biotechnologies, 59 Mărăşti Blvd., District 1, Bucharest, Romania
[2]SC PICCOLO ANGELO SRL, 7 Valea cu Tei Street, Tulcea, 827080, Greci, Romania

Corresponding author email: lauramariav21@gmail.com

Abstract

The present study analyses the impact of the product obtained by incorporating broccoli microplants (microgreens/sprouts) into a cow's white cheese pie on the sensory acceptability and purchasing preferences of the final consumer. Broccoli microplants (microgreens/sprouts) were obtained under aseptic conditions and incorporated in different proportions into the pie, in compliance with food safety requirements. The product was evaluated by means of sensory analysis and an online questionnaire. The obtained results indicate a moderate influence on aroma and texture, without negatively affecting overall acceptability, while taste and colour were positively evaluated. Taste and perceived quality proved to be determining factors in the purchase decision, alongside a price level considered appropriate. The recorded results indicate a favourable acceptance of the product and highlight the potential of broccoli microplants (microgreens/sprouts) as a functional ingredient in formulations of cow's white cheese (telemea) pie.

Key words*: broccoli, cow's white cheese (telemea) pie, microplants (microgreens/sprouts).*

INTRODUCTION

Broccoli (*Brassica oleracea* var. *italica*) is recognized as a member of *Brassica oleracea* Broccoli Group (USDA, Agricultural Research Service, 2026a), with economic use as human food by flower buds and sprouts (USDA, Agricultural Research Service, 2026b). Broccoli flower buds have nutrient density supports and health benefits that are considered as a superfood (Drăghici et al., 2023). But, on the other hand, broccoli sprouts, by comparation with mature broccoli, have higher levels of metabolically active compounds and reduce chronic disease risks (Hong, 2020).

Broccoli sprouts may be processed into powders (Xu et al., 2013), capsules (Park, 2006) and granules (Jang, 2024), or may be used in functional foods for easy consumption and health benefits. Additionally, another advantage of broccoli sprouts is that support the marketability (Popa et al., 2022), and consumers show preference for functional broccoli sprout products (Geicu-Cristea et al., 2023). At the same time, there is a need for strict elimination of microorganisms during seed germination and sprout development to ensure that the sprouts are safe and suitable for consumption.

Taking into account the information presented above, broccoli microplants (microgreens/ sprouts; MMS) were obtained under aseptic conditions (Livadariu and Adam, 2025). By incorporating broccoli MMS into a cow's white cheese (telemea) pie, a new product was developed.

Consequently, the present study highlights the influence of broccoli MMS added to a cow's white cheese (telemea) pie on the purchasing preferences of the final consumer, assessed through sensory analysis and an online questionnaire.

The findings, supported by detailed charts and analyses, highlight the new product's sensory attributes, examine consumer acceptance and purchasing behaviour associated with the addition of broccoli MMS. These insights enhance the understanding of the market

potential for a functional new product consisting of the integration of broccoli MMS into cow's white cheese pie formulations (= the product cow's white cheese (telemea) pie with broccoli MMS) and provide key considerations related to consumer preferences.

MATERIALS AND METHODS

Method for obtaining broccoli microplants (microgreens/sprouts). Broccoli seeds *(Brassica oleracea* var. *italica)* were purchased from a commercial source and aseptically sterilized prior to inoculation (Di Bella et al., 2020; Hong, 2021; Livadariu and Adam, 2025). The substrate for seed germination and the growth of broccoli MMS was prepared under aseptic conditions (Barbu et al., 2024; Livadariu et al., 2025; Livadariu and Adam, 2025).

Broccoli microplants (microgreens/sprouts) were obtained under aseptic and growth conditions (Livadariu et al., 2025), which allowed harvesting of broccoli MMS after 14 days (Livadariu and Adam, 2025).

Method for obtaining the product cow's white cheese (telemea) pie with broccoli microplants (microgreens/sprouts). The technological process for obtaining the product cow's white cheese (telemea) pie with broccoli MMS consisted of six main stages: harvesting, dosing, combining, baking, cooling, and packaging. These stages were carried out within the facilities of SC PICCOLO ANGELO SRL.

The harvesting of broccoli MMS was conducted together with the edible substrate and included mixing them using a blender (Livadariu and Adam, 2025).

The dosing consisted of weighing the raw materials: flour, water, oil, vinegar, salt, cow's white cheese (telemea), fresh curd cheese (caș), eggs, yogurt, and broccoli MMS mixed with the growth substrate.

The combination of the raw materials included a sequence of sub-stages, namely:

a) kneading the sifted flour together with water, oil, vinegar, and salt until the dough was obtained;

b) dividing, rolling, and stretching the dough;

c) filling the dough with a mixture composed of cow's white cheese (telemea), eggs and broccoli MMS and

d) shaping the dough into a pie, placing it in baking trays and brushing with a mixture of yogurt and egg.

Baking was carried out at 200℃ (392°F) for 40 minutes, and cooling was performed by maintaining the product at room temperature for 15 minutes. Packaging was done in transparent containers with lids.

By completing the six main stages of the technological process the product cow's white cheese (telemea) pie with broccoli MMS was obtained. This product was portioned and tested by the final consumer through sensory analysis.

The **experimental variants** tested by the final consumer consisted of one control variant, which did not contain broccoli MMS and four variants containing broccoli MMS in different amounts, established as percentages of the total quantity of broccoli MMS obtained by mixing with the edible substrate, as follows:

- Control = cow's white cheese (telemea) pie without broccoli MMS;
- Variant 1 = the product cow's white cheese (telemea) pie with 25% broccoli MMS;
- Variant 2 = the product cow's white cheese (telemea) pie with 50% broccoli MMS;
- Variant 3 = the product cow's white cheese (telemea) pie with 75% broccoli MMS;
- Variant 4 = the product cow's white cheese (telemea) pie with 100% broccoli MMS.

The **method of statistical processing** used an online questionnaire completed by final consumers after the sensory analysis of the product, in order to explore the influence of broccoli microplants (*Brassica oleracea* var. *italica*) added to the cow's white cheese (telemea) pie, on the purchasing preferences of the final consumer.

The questionnaire was created using the Google Forms platform (Geicu-Cristea et al., 2023), and was distributed through the employees of the company Moesis by Angelo, in order to facilitate efficient and cost-effective data collection. It consisted of 22 questions, structured to collect information both for grouping the final consumers according to age and gender and for identifying the perception of the final consumer regarding the product cow's white cheese (telemea) pie with broccoli MMS.

The online questionnaire was divided into three main sections:

- the profile of the final consumer according to age and gender (through 2 questions);

- the sensory preferences of the final consumer (through 7 questions regarding aroma, colour, taste, and texture);
- the behaviour of the final consumer (through 3 questions related to the most important sense in choosing a pie-type product, the price for 1 kg of the product cow's white cheese (telemea) pie with broccoli MMS, and the dominant factor in the choice of a food product).

The sensory analysis was conducted with 56 evaluators randomly selected from the company's personnel. Each final consumer evaluated all 5 products. The samples were first labelled and marked with a code created for each sample individually, and subsequently served in increasing order of the broccoli MMS content. Prior to the start of the evaluation, the participants were informed about the sensory analysis procedure and GDPR regulations.

RESULTS AND DISCUSSIONS

After obtaining the new product cow's white cheese (telemea) pie with broccoli MMS, the final step in highlighting the influence of broccoli MMS added to the cow's white cheese (telemea) pie on the purchasing preferences of the final consumer consisted of conducting a sensory analysis, followed by an online questionnaire based on its results.

The first part of the questionnaire outlined the profile of the final consumer using information related to age and gender. The age of the final consumers ranged from 18 to over 58 years, with the highest percentage (37%) recorded in the 49-58 age group (Figure 1).

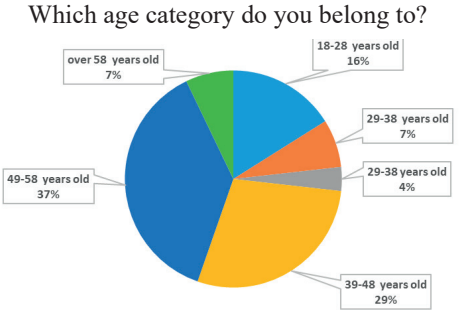

Figure 1. The results show that most respondents belong to the middle-age categories, indicating a mature consumer profile

Meanwhile, the gender distribution of the final consumers was predominantly female, accounting for 84% (Figure 2).

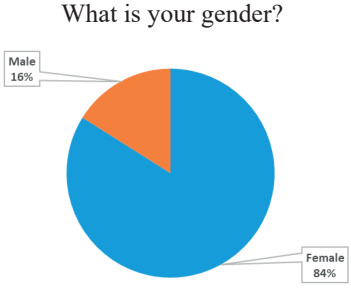

Figure 2. The sample is predominantly female, suggesting a higher interest among women in the evaluated product

The second part of the questionnaire highlighted the sensory preferences of the final consumer for the product cow's white cheese (telemea) pie with broccoli MMS, through information regarding aroma (Figure 3), colour (Figure 4), taste (Figures 5-8), and texture (Figure 9).

The aroma of the product cow's white cheese (telemea) pie with broccoli MMS (Figure 3) was perceived by the highest percentage of final consumers (38%) as being slightly changed. However, a proportion of the final consumers considered that the aroma of the product was changed to a large extent (21%), to a very large extent (20%), to a very small extent (14%), while only 7% indicated that they did not know. These data reflect the subjective perception of the final consumer and indicate the capacity of broccoli MMS to influence the aroma of the tested product.

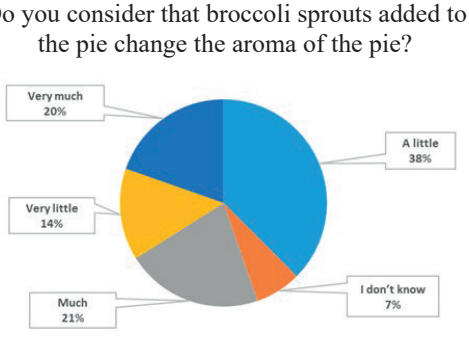

Figure 3 Broccoli sprouts are perceived to moderately influence the aroma of the pie

The colour of the product cow's white cheese (telemea) pie with broccoli MMS was perceived by the highest percentage of final consumers (84%) as pale green. However, some final consumers considered the product colour to be yellow-green (2%) or intense green (14%). These data indicate the stability of colour in the perception of the final consumer.

Do you prefer the product pie with broccoli sprouts to have a certain colour/shade?

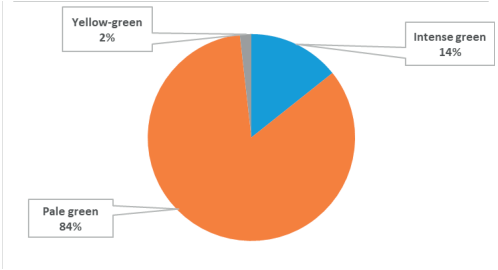

Figure 4. A pale green colour is the most preferred shade for the product

The taste of the product cow's white cheese (telemea) pie with broccoli MMS was perceived by the highest percentage of final consumers as very satisfactory (39%) (Figure 5), dominant (34%) (Figure 6), salty (55%) (Figure 7), and moderate (39%) (Figure 8). These data indicate the ability of broccoli MMS to positively influence taste.

In addition, by analysing the results presented in Figure 8, a preference of the final consumer can be observed for the experimental variant consisting of the product cow's white cheese (telemea) pie with 50% broccoli MMS (Variant 2).

How would you rate the taste quality of the product pie with added broccoli sprouts?

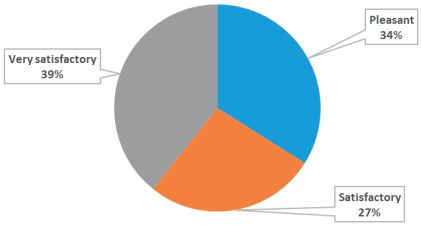

Figure 5. The taste quality of the product was rated positively by most consumers

What is the dominant taste of the pie with broccoli sprouts?

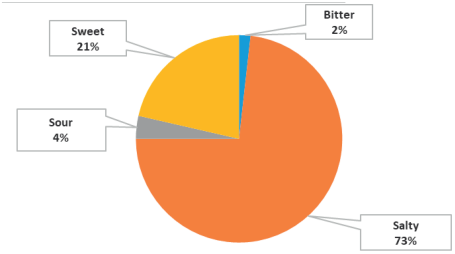

Figure 6. The dominant taste perceived by consumers is salty

Do you prefer the pie with broccoli sprouts to have a taste that is:

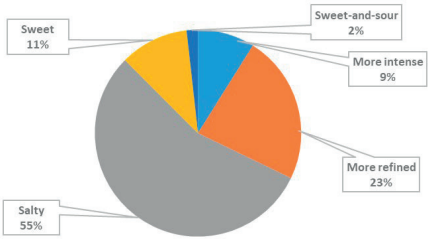

Figure 7. Consumers generally prefer a salty or more refined taste profile for the product

Do you consider that the product pie with broccoli sprouts should contain a certain amount of sprouts?

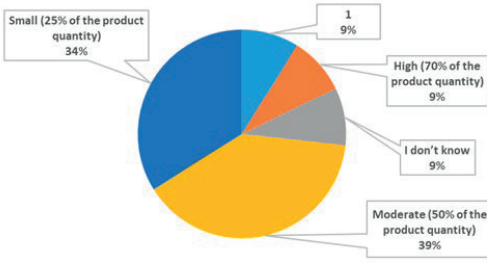

Figure 8. Consumers mainly prefer a small to moderate amount of broccoli sprouts in the product

The texture of the product cow's white cheese (telemea) pie with broccoli MMS was perceived by the highest percentage of final consumers as being slightly influenced (36%) by broccoli MMS However, a proportion of the final consumers considered that the texture of the product was changed to a very small extent (18%), not changed (18%), changed to a very

large extent (12%), or changed to a large extent (11%), while only 5% indicated that they did not know. These data indicate that broccoli MMS do not significantly influence the texture of the product. This aspect may contribute to easier acceptance of the product by potential final consumers who prefer the conventional texture of a cow's white cheese (telemea) pie.

Do you consider that the addition of broccoli sprouts changed the texture of the pie?

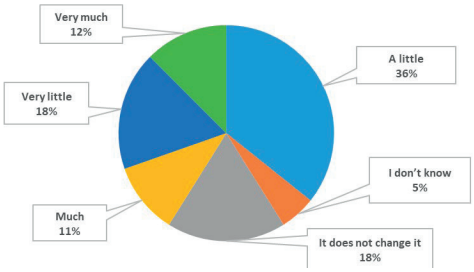

Figure 9. Most respondents consider that broccoli sprouts slightly affect the texture of the pie

The third part of the questionnaire highlighted the behaviour of the final consumer through information regarding the most important sense in choosing a pie-type product (Figure 10), the price for 1 kg of the product cow's white cheese (telemea) pie with broccoli MMS (Figure 11), and the dominant factor in the choice of a food product (Figure 12).

According to the opinion of the final consumer, the most important sense in choosing a pie-type product was taste (84%) (Figure 10), while the olfactory sense ranked second (7%), followed by the visual sense (5%) and the tactile sense/texture (4%).

The price for 1 kg of the product cow's white cheese (telemea) pie with broccoli MMS (Figure 11), in the opinion of the final consumer, was considered most appropriate at 43 RON (37%). While the values of 48 RON (34%), 38 RON (25%), 53 RON (2%), and 58 RON (2%) indicate a preference of the final consumer for a price range between 43 and 48 RON.

The dominant factor in the choice of a food product (Figure 12), according to the opinion of the final consumer, was quality (57%). However, a proportion of the final consumers considered price (21%), brand (7%), and packaging (6%) to be more important than the quality of a food product. These data indicate that the purchasing decision of the final consumer is influenced by quality and price as cumulative factors with a decisive role in the selection of a food product.

From your point of view, which sense is the most important when choosing a pie?

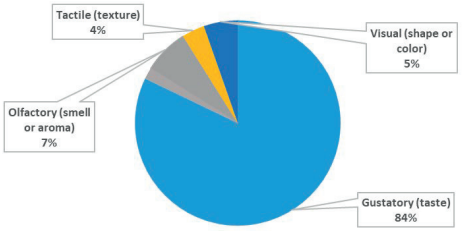

Figure 10. Taste is considered the most important sense when choosing a pie

What would be the maximum amount you would be willing to pay for 1 kg of the product pie with added broccoli sprouts?

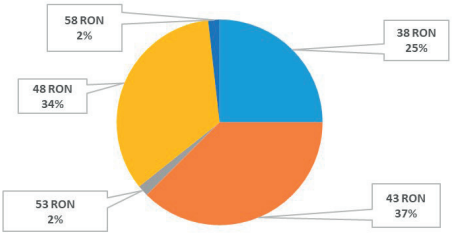

Figure 11. Most consumers are willing to pay a moderate price for one kilogram of the product

Which of the following factors influence you the most when choosing a food product?

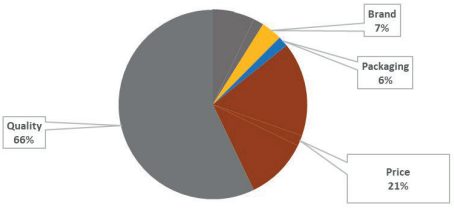

Figure 12. Quality is the dominant factor influencing consumers when choosing a food product

The recorded results show that broccoli MMS added to cow's white cheese (telemea) pie positively influence the purchasing preferences

of the final consumer. The aroma and texture of the product were perceived as being slightly influenced, without affecting overall acceptability. Colour was appreciated by the majority of respondents, being considered stable and attractive.

Taste proved to be the main sensory factor, being predominantly evaluated as satisfactory, while maintaining the characteristic salty profile of the product. Consumers prefer a low to moderate content of broccoli MMS, indicating the need for an optimal dosage.

In the purchasing decision, quality and taste are the dominant factors, and the product cow's white cheese (telemea) pie with broccoli MMS was associated with a purchase price in the range of 43-48 RON per 1 kg. In conclusion, the integration of broccoli MMS represents a viable opportunity for diversifying the product cow's white cheese (telemea) pie, with good potential for acceptance among final consumers.

CONCLUSIONS

This study presents information on the influence of broccoli MMS added to the cow's white cheese (telemea) pie on the purchasing preferences of the final consumer.

The experimental data obtained through sensory analysis and the online questionnaire indicate favourable acceptance of the product cow's white cheese (telemea) pie with broccoli MMS. The influence of broccoli MMS on aroma (38%) and texture (36%) was perceived as moderate, without a negative impact on overall product acceptability, while moderate taste (39%) and pale green colour (84%) were evaluated positively. Taste was identified as the main sensory factor in the purchasing decision, together with perceived quality and a price considered appropriate (43-48 RON per 1 kg of product).

The experimental results highlight the influence of broccoli MMS on the purchasing preferences of the final consumer and indicate that the experimental variant consisting of the product cow's white cheese (telemea) pie with 50% broccoli MMS has potential as an innovative food product.

ACKNOWLEDGEMENTS

The experiment was conducted within the Faculty of Biotechnologies, University of Agronomic Sciences and Veterinary Medicine of Bucharest and the facilities of SC PICCOLO ANGELO SRL.

REFERENCES

Barbu, L.-D.-N., Livadariu, O., Boiu-Sicuia, O.-A., Dobrin, A., Ion, V. A., Constantin, C. G., & Băbeanu, N.-E. (2024). Evaluation of aseptic and non-aseptic systems and substrate effects on sorrel microplants cultivated under LED irradiation. *AgroLife Scientific Journal, 13*(2), 55–64. (https://doi.org/10.17930/AGL202425).

Di Bella, M. C., Niklas, A., Toscano, S., Picchi, V., Romano, D., Lo Scalzo, R., & Branca, F. (2020). Morphometric characteristics, polyphenols, and ascorbic acid variation in *Brassica oleracea* L. novel foods: Sprouts, microgreens, and baby leaves. *Agronomy, 10*(6), 782. (https://doi.org/10.3390/agronomy10060782).

Drăghici, M. C., Geicu-Cristea, M., Popa, E. E., Miteluț, A. C., Popescu, P. A., Tylewicz, U., Dalla Rosa, M., & Popa, M. E. (2023). Research on blanching pretreatment and freezing technology effect on selected vegetables. *AgroLife Scientific Journal, 12*(2), 69–76. (https://doi.org/10.17930/AGL202329).

Geicu-Cristea, M., Popa, E. E., Manea, P. G., Drăghici, M. C., Miteluț, A. C., Popescu, P. A., & Popa, M. E. (2023). Romanian consumer attitudes regarding alternative protein sources. *Scientific Bulletin. Series F. Biotechnologies, XXVII*(2), 151–157. (https://biotechnologyjournal.usamv.ro/pdf/2023/issue_2/ Art18.pdf).

Hong, H. (2020). Method for improving content of glucosinolate in broccoli sprouting vegetables (Publication No. CN110915468A). Chengdu Sanherb Bioscience CO. LTD. 48 (https://worldwide.espacenet.com/patent/search/family/069860795/publication/CN110915468A?q=pn%3DCN110915468A. Accessed 5 February 2026).

Hong, H., & Chen, G. (2021). Green high-yield cultivation method for broccoli sprouting vegetables (Publication No. CN113142037A). Chengdu Sanherb Bioscience Co. Ltd. (https://worldwide.espacenet.com/patent/search/family/076871947/publication/CN113142037A).

Livadariu O., Adam A. (2025). Highlighting the influence of broccoli microplants (*Brassica oleracea* var. *italica*) addition to vegan yoghurt on the final consumer purchasing preferences. *Scientific Bulletin. Series F. Biotechnologies, Vol. XXIX, Issue 2*, ISSN 2285-1364, 41-48. (https://biotechnologyjournal.usamv.ro/pdf/2025/issue_2/Art5.pdf).

Park, G. H. (2006). Broccoli sprout drek (Publication No. KR20060122655A).
(https://worldwide.espacenet.com/patent/search/family/037707957/publication/KR20060122655A).

Livadariu, O. Băbeanu, N.-E., Barbu, L.-D.-N., Boiu-Sicuia, O.-A., Peticilă, A.-G., Constantin, C. G., Dobrin, A., Ion, V.-A., Venat, C. O. A., Nicolae, I. C., Lagunovschi-Luchian, V., Badea, M. L. (2025). Composite food product and technology for preparing the composite food product made of micro-plantlets (sprouts/microgreens) and food-grade substrate (Publication No. RO138290A1)
(https://worldwide.espacenet.com/patent/search/family/091960737/publication/RO138290A1?q=RO138290A1**).**

Popa, E. E., Anghel, A. A., Stanciu, I., Miteluț, A. C., Popescu, P. A., Drăghici, M. C., Geicu-Cristea, M., & Popa, M. E. (2022). Preliminary research on using organic sea buckthorn powder in bread making. *AgroLife Scientific Journal, 11*(2). (https://doi.org/10.17930/AGL20222180.

Jang, J. G. (2024). Method of manufacturing granule of broccoli sprout (Publication No. KR102690990B1). Daekyung SB Co., Ltd.
(https://worldwide.espacenet.com/patent/search/family/083804449/publication/KR102690990B1).

USDA, Agricultural Research Service, National Plant Germplasm System. (2026a). Germplasm Resources Information Network (GRIN Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. (https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomydetail?id=105447. Accessed 5 February 2026).

USDA, Agricultural Research Service, National Plant Germplasm System. (2026b). Germplasm Resources Information Network (GRIN Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. (https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomydetail?id=105447 Accessed 5 February 2026).

Xu, X., Tian, M., Pan, S., Wang, K., & Wang, L. (2013). Rich-in-sulforaphane broccoli sprout powder and production method thereof (Publication No. CN103416688A). Huazhong Agricultural University.
(https://worldwide.espacenet.com/patent/search/family/049642492/publication/CN103416688A?q=CN103416688A).