

Functional and Nutritional Foods Obtained Through Cantaloupe Processing

Toma (Vapor) CRISTINA^{1,2,*}, Gheorghița HOZA¹, Radu-Andrei STERIAN^{1,2}, Popescu SIMONA², Dorel HOZA¹

¹University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd, District 1, Bucharest, Romania

²ICDIMP-HORTING Institute, Bucharest, Romania

*Corresponding author: cristina.vapor11@gmail.com

Abstract. The culture of melon (*Cucumis melo* L.) is widespread in many countries. Melons are consumed fresh due to their bioactive compounds such as vitamin C, folic and ascorbic acids, and their β -carotene content, making them suitable for healthy diets. They are also processed into various products, representing an alternative for reducing food waste. The experiment was established at ICDIMP Horting, and the plant material used consisted of two melon hybrids: Raymond and Master. The study of melon hybrids in the industrial processing process led to the development of new products: syrup, purée, and nectar with high nutritional value. The aim of the study was to highlight the potential for use in the food industry and the preservation of the initial organoleptic characteristics and physico-chemical properties of melon fruits through processing technology. The diversification of melons through preservation enables the consumption of finished products outside the harvesting season. The analyses performed in the chemistry laboratory assessed the products from an organoleptic, microbiological and nutritional perspective.

Keywords: *Cucumis melo*, fruit, hybrid, organoleptic, valorization

INTRODUCTION

Cantaloupe cultivation is widespread in many parts of the world, and the fruit is delightful, oval-shaped, with slight variations depending on the variety. The fresh fruit has high nutritional value and is widely consumed in many tropical countries. Gaikwad et al. (2024) provided an overview of *Cucumis melo* L., highlighting its physicochemical properties and quality traits. Their research evaluated how different organic solvents affected the recovery of phytochemicals from the fruit and seeds of *Cucumis melo* L. Saeed et al. (2023) studied the nutritional and functional properties, as well as the antioxidant profile, of *Cucumis melo* and *Citrullus lanatus* seeds. The results showed that the protein, fat, and fiber content of *Cucumis melo* seed powder was significantly ($p < 0.05$) higher than that of *Cucumis lanatus* seeds. The study concluded that *Cucumis melo* L. represents a valuable and superior source of essential nutrients, along with bioactive components that enhance its technological properties.

Ricardo et al. (2020) summarize information in their study regarding the bioactive compounds present in watermelon fruit, along with its nutritional properties as a functional food, emphasizing its by-products (pulp, seeds, and rind). They also conclude that extracts from cantaloupe rind contain phytochemical compounds with antioxidant, antimicrobial, antidiabetic, antiviral, anti-inflammatory, antihypoglycemic, and antiproliferative effects in various in vitro and in vivo tests. The authors highlight the need for further analysis of the nutritional and functional potential of these by-products, the involved therapeutic and clinical mechanisms, and the development of their industrial processing into functional foods or nutraceutical products.

Ana L. et al. (2015) report the levels of biologically active compounds in cantaloupe. These levels vary greatly and are dependent on the genotype and environmental conditions during production and post-harvest handling, due to strong interactions between cultivar and environmental effects. The content of ascorbic acid and the concentration of β -carotene vary significantly depending on the genotype and are influenced by processing conditions. During storage and processing of raw materials, phenolic compounds are generally preserved.

One way to consume cantaloupe is in the form of juice, with the possibility of adding ingredients such as plant extracts to enhance its nutritional value and/or taste. Accordingly, Javier et al. (2018) investigated the improvement of the functional properties of "Piel de Sapo" cantaloupe juice by increasing the content of bioactive agents (e.g., polyphenols) through the addition of a natural extract of *Lippia citriodora* (lemon verbena) and probiotic lactic acid bacteria.

Cucumis melo L., commonly consumed as a fruit, generates rinds and seeds that are usually discarded. Cantaloupe waste represents a significant environmental, economic, and social challenge worldwide. Rolim (2019) presents an alternative through the valorization of by-products due to their bioactive compounds. The nutritional composition and antioxidant potential of the pulp, rind, and seeds of *Cucumis melo* L. are highlighted in the work of Silva et al. (2025).

Ricardo et al. (2021) emphasized the potential of *Cucumis melo* rinds (cultivar *Inodorus*) for their nutritional properties, bioactive compound content, antioxidant activity, and potential applications in the food and pharmaceutical industries.

According to research, Sangar et al. (2025) reported that *Cucumis melo* L. exhibits good functional properties through its water and oil retention capacity. Cantaloupe rinds have properties that can be utilized in industrial applications due to the pigments present.

Rabadán et al. (2020) studied nine cantaloupe varieties regarding the oil content of their seeds using two extraction methods (screw press and hydraulic press). The results showed that cantaloupe seeds can be used as a new source of healthy oils, with high polyunsaturated fatty acid content, primarily linoleic acid, and a high concentration of vitamin E (Guoqiang, 2024; Rabadán et al., 2020).

Tarek et al. (2021) studied the nutritional quality and functional properties of flours from watermelon, pepper, and pumpkin seeds, as well as the characteristics of the seed oils. These could be successfully used as sources of edible oils and proteins for human consumption. The high level of unsaturated fatty acids makes watermelon seed oil nutritionally valuable, as supported by Mallek et al. (2018).

MATERIAL AND METHODS

The experiment was conducted at ICDIMPH Horting, using two cantaloupe (*Cucumis melo* L.) hybrids: *Raymond* and *Master*.

This study focuses on exploring the valorization potential of cantaloupe fruits-specifically the *Master* and *Raymond* hybrids for the development of value-added products such as syrup, purée, and nectar.

The nutritional characteristics of the fruit, including its bioactive compound content, antioxidant capacity, and potential applications in the food industry, served as the foundation for producing these products. For the cantaloupe syrup, following the technological procedure, the fruits were washed, peeled, and the pulp was cut and blended to obtain the juice. Sugar was then added, the juice was concentrated, and finally, lemon juice was incorporated.



Figure 1. Stages in the technological process of obtaining the “Cantaloupe Syrup” product.

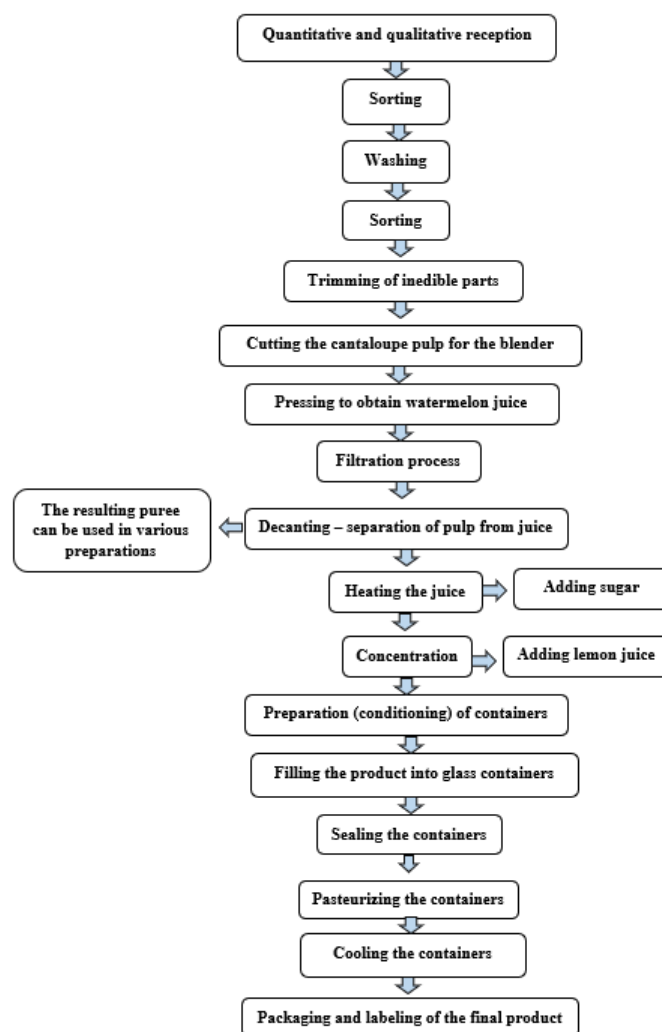


Figure 2. Flow diagram of the cantaloupe syrup production process

For the preparation of the purée, the cantaloupes were washed, peeled, and the pulp was divided. Depending on the hybrid and in order to preserve the vitamins, the blanching time varied. For the *Master* hybrid, blanching lasted 5 minutes, as the pulp was firmer compared to the *Raymond* hybrid, where the blanching time was 2 minutes. This was followed by blending the pulp to obtain the purée. The purée was then heated, filled into containers, and pasteurized at 100°C.

The dry matter content of the *Master* hybrid purée was 8°R, while that of the *Raymond* hybrid was 11°R. The refractometric grades of the products are determined using the Krüss refractometer. (°R - refractometric degrees)



Figure 3. Stages in the technological process of obtaining the cantaloupe purée

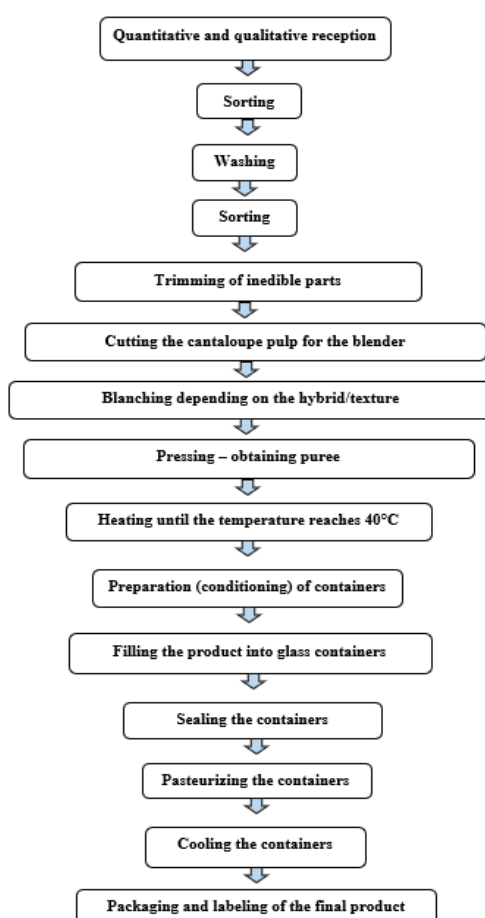


Figure 4. Flow diagram of the technological process for cantaloupe purée production

For the *Cantaloupe Nectar* product, according to the technological flow, the melons were washed, peeled, and the pulp was divided, blended, and blanched for different durations depending on the hybrid. The syrup (water + sugar) and the cantaloupe purée were homogenized using a blender, thus forming the nectar. The mixture was concentrated until the dry matter reached 28°R, and finally, lemon juice was added. (°R - refractometric degrees)

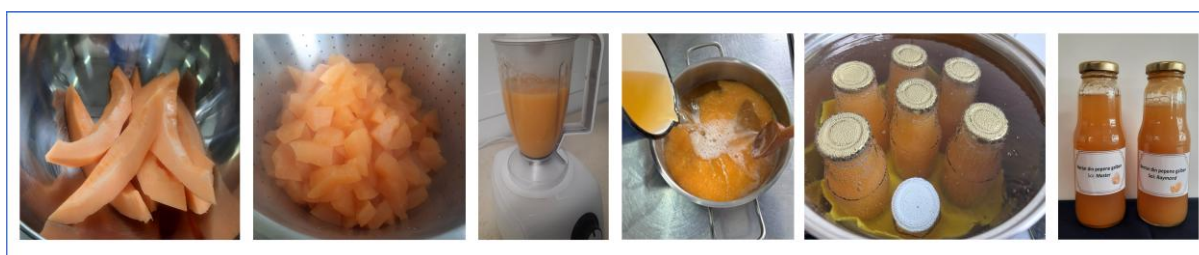


Figure 5. Stages in the technological process of cantaloupe nectar production

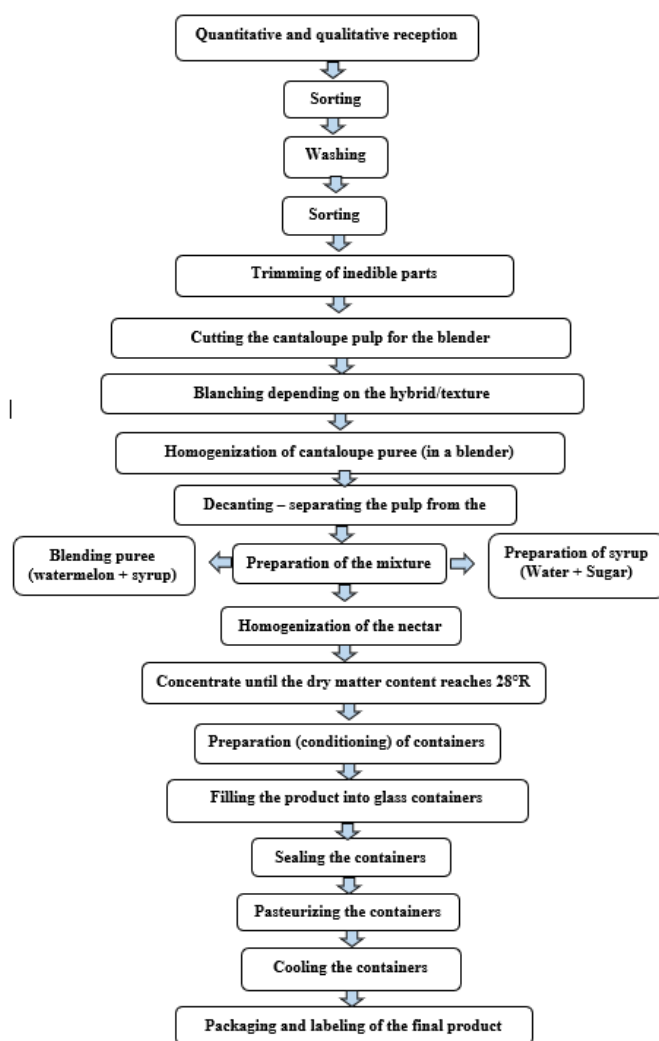


Figure 6. Technological flow of cantaloupe nectar production

RESULTS AND DISCUSSIONS

The physicochemical values of the raw material—fresh cantaloupe—and the processed products (syrup, nectar, and purée) were determined at the Chem Analyst Laboratory. The microbiological analyses of the samples complied with the specification sheet for the analyzed parameters. Yeasts and molds were analyzed according to SR ISO 21527/2:2009, where the colony-forming unit (CFU/ml) was <1, and Enterobacteriaceae were analyzed according to SR ISO 21528/2:2017, where the colony-forming unit (CFU/ml) was <1.

In Table 1, the total invert sugar was determined according to SR 2213-12:2009 using the traditional volumetric method for sweet food products. The analytical methodology for the determination of total and saturated fat content was applied in accordance with SR 2213-11:2007. Another physicochemical characteristic analyzed was protein, which was determined following SR 2213-17:2009, the analytical method for quantifying total protein content.

The products were evaluated sensorially according to the STR 3197-83 standard using the paired comparison method. This method allows the comparison of the two cantaloupe hybrids, *Master* and *Raymond*, in order to determine the differences and the intensity of specific sensory organoleptic attributes. The evaluation yielded a favorable result, as shown in the presented graphs.

Table 1. Sensory and physicochemical analysis of fresh cantaloupe fruits

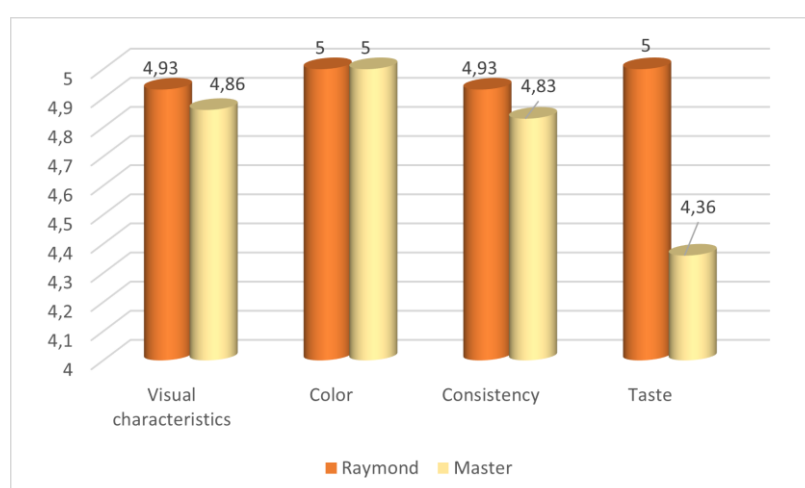
CHARACTERISTICS	MAXIMUM ALLOWED	METHOD OF ANALYSIS	RESULTS – <i>Raymond Hybrid</i>	RESULTS – <i>Master Hybrid</i>
Product Appearance	According to the standards	STAS 2213-1/1988	Fruit with juicy, sweet yellow flesh, containing edible and nutritious seeds, surrounded by a hard yellow rind, with a distinctive taste and aroma	Fruit with juicy, sweet yellow flesh, containing edible and nutritious seeds, surrounded by a hard yellow rind, with a distinctive taste and aroma
Moisture (%)	According to the standards	SR 2213-4:2007	90.06	87.97
Total Inverted Sugar (g/100 g)	According to the standards	SR 2213-12:2009	6.97	7.09
Total Fat (g/100 g)	According to the standards	SR 2213-11:2007	0.15	0.11
Saturated Fat (g/100 g)	According to the standards	SR 2213-11:2007	0.00	0.00
Protein (g/100 g)	According to the standards	SR 2213-17:2009	0.50	0.47
Total Carbohydrates (g/100 g)	According to the standards	Norma met. 0702/2002	7.6	8.97
Sodium Chloride (g/100 g)	According to the standards	SR91:2007	0.15	0.21
Total Ash (g/100 g)	According to the standards	SR 2213-6:2009	1.34	1.63
Fiber (%)	According to the standards	Norma met 07/02/2002	0.87	0.85
Caloric/Energy Value	According to the standards	Norma met 07/02/2002	33.41 / 141.37	40.45 / 171.35
Kcal per 100 ml / KJ per 100 g	According to the standards	Farm. Rom.ed.a X-a/93	0.26	0.20

The cantaloupe syrup analyzed organoleptically showed the appearance of a viscous liquid, with small suspended particles of fruit pulp being acceptable. The color, taste, and aroma of the syrup were characteristic of cantaloupe.

**Figure 7.** Concentrated cantaloupe syrup: presentation and method of preparing refreshing drinks

Table 2. Sensory and physicochemical analysis of cantaloupe syrup

Characteristics	Maximum allowed	Method of analysis	Results – <i>Raymond</i> Syrup	Results – <i>Master</i> Syrup
Appearance	According to the standards	STAS 756-1/1985	Uniform opalescent liquid, free from impurities, with no suspended particles or deposits	Uniform opalescent liquid, free from impurities, with no suspended particles or deposits
Color	According to the standards	STAS 756-1/1985	Yellow-brown	Yellow-brown
Smell	According to the standards	STAS 756-1/1985	Characteristic	Characteristic
Taste	According to the standards	STAS 756-1/1985	Characteristic	Characteristic
Impurities	According to the standards	STAS 756-1/1985	Absent	Absent
Acidity (g citric acid / 100 g)	According to the standards	Farm. Rom.ed.a X-a/ 93	0.28	0.26

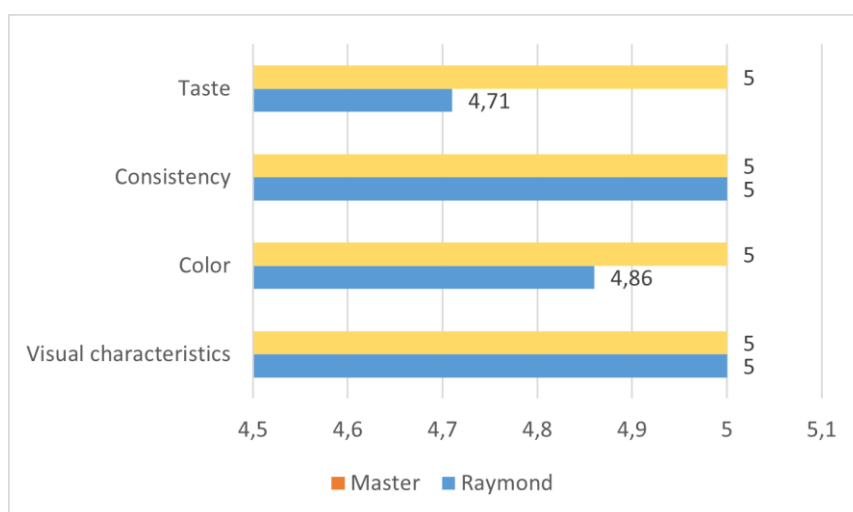
**Figure 8.** Sensory evaluation results of cantaloupe syrup

Following the sensory evaluation, the cantaloupe syrup was well appreciated organoleptically.

The *Master* hybrid was less favored in terms of taste, exhibiting a pumpkin-like flavor. It is recommended to consume the syrup diluted with cold mineral water, and optionally, with the addition of lemon juice and fresh mint.

Table 3 – Sensory and Physicochemical Analysis of Melon Nectar

Characteristics	Maximum allowed	Method of analysis	Nectar Results – <i>Raymond Hybrid</i>	Nectar Results – <i>Master Hybrid</i>
Appearance	According to the standards	STAS 756-1/1985	Uniform liquid, clear of impurities, without suspended particles or sediment	Uniform liquid, clear of impurities, without suspended particles or sediment
Color	According to the standards	STAS 756-1/1985	Yellow-brown	Yellow-brown
Smell	According to the standards	STAS 756-1/1985	Characteristic	Characteristic
Taste	According to the standards	STAS 756-1/1985	Characteristic	Characteristic
Impurities	According to the standards	STAS 756-1/1985	Absent	Absent
Citric Acid Content (g/100 g)	According to the standards	Farm. Rom.ed.a X-a/ 93	0.46	0.12

**Figure 9.** Evaluation of Tasting Results – Melon Nectar

The *Raymond* hybrid melon nectar was highly appreciated by the tasters, receiving the maximum score of 5. The *Master* hybrid received the maximum score for consistency and appearance, and a score of 4.86 for color. The pumpkin-like taste is also present in the *Master* hybrid melon nectar, receiving a score of 4.71.

Table 4 – Sensory and Physicochemical Analysis of Melon Puree

Characteristics	Maximum allowed	Method of analysis	Puree Results – <i>Raymond Hybrid</i>	Puree Results – <i>Master Hybrid</i>
Appearance	According to the standards	STAS 756-1/1985	Dense, homogeneous, and viscous mass, uniform in texture, free from impurities	Dense, homogeneous, and viscous mass, uniform in texture, free from impurities
Color	According to the standards	STAS 756-1/1985	Yellow-brown	Yellow-brown
Smell	According to the	STAS 756-1/1985	Characteristic	Characteristic

Taste	standards According to the standards	STAS 756-1/1985	Characteristic	Characteristic
Impurities	According to the standards	STAS 756-1/1985	Absent	Absent
Acidity (g citric acid / 100 g)	According to the standards	Farm. Rom.ed.a X- a/ 93	0.08	0.14

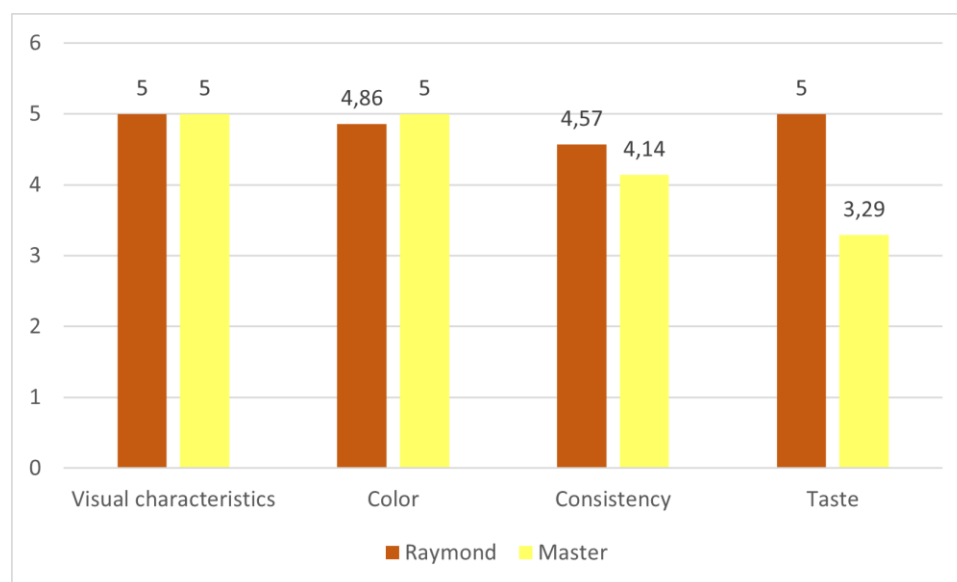


Figure 10. Graph of Tasting Results – Melon Puree

The melon puree from the *Raymond* hybrid was highly appreciated from an organoleptic perspective, including appearance, color, consistency, and taste. The difference between the melon purees of the two hybrids was small; for consistency, the *Master* hybrid scored 4.14 compared to 4.57 for the *Raymond* hybrid. The pumpkin-like taste was also preserved in the puree, with the *Master* hybrid scoring 3.29, while the *Raymond* hybrid received the maximum score of 5.

CONCLUSIONS

The study on the two melon hybrids during the industrialization process led to the production of high-quality products in terms of both organoleptic and microbiological characteristics. During the valorization process, the suitability of the melon hybrids for syrup, nectar, and puree was highlighted. The *Raymond* hybrid is suitable for syrup, puree, and nectar, as confirmed by tasting evaluations, while the *Master* hybrid, due to its pumpkin-like taste, is recommended to be processed in combination with other fruits.

From a nutritional perspective, cantaloupe hybrids contribute to the promotion of healthy diets. As shown in Table 1, the caloric/energy value for the *Raymond* hybrid is 33.41/141.37 kcal, while for the *Master* hybrid it is 40.45/171.35 kcal. Ricardo et al. (2020) report the bioactive compounds present in melons, their nutritional properties, and emphasize by-products (pulp, seeds, and rind).

Through the industrial processing of cantaloupe (*Cucumis melo*), an alternative valorization proposed in this study is the production of syrup for refreshing beverages. Javier et al. (2018) investigate the improvement of these products and the functional properties of cantaloupe juice through the addition of ingredients such as plant extracts.

Cantaloupe cultivation is appreciated by consumers both fresh and processed, with processed products offering nutritional and functional properties beneficial to human health. To reduce food waste, this study proposes alternative valorization methods.

ACKNOWLEDGMENTS

We thank the supervising professors at USAMV Bucharest, colleagues from ICDIMPH HORTING Bucharest, as well as the team of the Chem Analyst Laboratory for conducting the analyses.

REFERENCES

1. Ana L. Amaro, Ana Oliveira, Domingos P.F. Almeida. Chapter 20 - Biologically Active Compounds in Melon: Modulation by Preharvest, Post-harvest, and Processing Factors, Editor(s): Victor Preedy, Processing and Impact on Active Components in Food, Academic Press, 2015, Pages 165-171.
2. Gaikwad, Kiran & Narkhede, Mahesh & Ambhore, Jaya & Chandak, Chanchal. An overview of Cucumis melo L.'s physicochemical traits and health- promoting qualities. 2024, 11, 445-451.
3. Guoqiang Zhang, Ziqian Li, Afroditi Chatzifragkou, Dimitris Charalampopoulos. Efectul metodelor de procesare asupra conținutului fitochimic al semințelor de pepene galben (Cucumis melo L.) , Future Foods, 10.1016/j.fufo.2024.100399, 10, (100399) , (2024).
4. Javier Rúa, Iván López-Rodríguez, Javier Sanz, María Camino García-Fernández, María Pilar del Valle, María Rosario García-Armesto. Improving functional properties of “Piel de Sapo” melon juice by addition of a Lippia citriodora natural extract and probiotic-type lactic acid bacteria, LWT, Volume 96, 2018, Pages 75-81.
5. Maria Ladjane S de Melo, Narendra Narain, Pushkar S Bora, Characterisation of some nutritional constituents of melon (Cucumis melo hybrid AF-522) seeds, Food Chemistry, Volume 68, Issue 4, 2000, Pages 411-414,
6. Mohammad Affan Fajar Falah, Meydi Dima Nadine, Ag. Suryandono. Effects of Storage Conditions on Quality and Shelf-life of Fresh-cut Melon (Cucumis Melo L.) and Papaya (Carica Papaya L.), Procedia Food Science, Volume 3, 2015, Pages 313-322
7. Rabadán, A., Nunes, MA., Bessada, SMF., Pardo, JE., Oliveira, MBPP, Álvarez-Ortí, M. De la produs secundar la lanțul alimentar: Semințele de pepene galben (*Cucumis melo* L.) ca sursă potențială de uleiuri. *Foods*, 2020, 9, 1341.
8. Ricardo Gómez-García, Débora A. Campos, Ana Oliveira, Cristóbal N. Aguilar, Ana R. Madureira, Manuela Pintado. A chemical valorisation of melon peels towards functional food ingredients: Bioactives profile and antioxidant properties, Food Chemistry, 2021, Volume 335, 127579, ISSN 0308-8146.
9. Ricardo Gómez-García, Débora A. Campos, Cristóbal N. Aguilar, Ana R. Madureira, Manuela Pintado. Valorization of melon fruit (Cucumis melo L.) by-products: Phytochemical and Biofunctional properties with Emphasis on Recent Trends and Advances, Trends in Food Science & Technology, Volume 99, 2020, pages 507-519, ISSN 0924-2244.
10. Rolim Priscilla Moura, Larissa Mont'Alverne Jucá Seabra și Gorete Ribeiro de Macedo. „Produse secundare de pepene galben: biopotențial în sănătatea umană și procesarea alimentelor”. Food Reviews International 2019, 36 (1): 15–38.
11. Saeed, Farhan & Afzaal, Muhammad & Niaz, Bushra & Hussain, Muzzamal & Rasheed, Amara & Raza, Muhammad & Umar, Maryam & Khan, Muhammad & Suleria, Hafiz & Tufail, Tabussam & Al Jbawi, Entessar. Comparative study of nutritional composition, antioxidant activity and functional properties of Cucumis melo and Citrullus lanatus seeds powder. Cogent Food & Agriculture, 2023, 10.1080/23311932.2023.2293517.
12. Sana Mallek-Ayadi, Neila Bahloul, Nabil Kechaou. Chemical composition and bioactive compounds of Cucumis melo L. seeds: Potential source for new trends of plant oils, Process Safety and Environmental Protection, Volume 113, 2018, Pages 68-77.
13. Sangar, Mangalagowri & Zakaria, Zarinah & Hussin, Napisah & Shahidan, Norshazila. Dietary Fiber and Functional Properties in peel and seed of Cucumis melo L. Flour: A Review. Bioscience Research, 2025. https://www.researchgate.net/publication/389777116_Dietary_Fiber_and_Functional_Properties_in_peel_and_seed_of_Cucumis_melo_L_Flour_A_Review.
14. Silva, Mafalda & Gonçalves Albuquerque, Tânia & Ferreira, Diana & Alves, Rita & Oliveira, Maria & Costa, Helena. Nutritional and Bioactive Profiling of Cucumis melo L. By-Products: Towards a Circular Food Economy. Molecules, 2025, 30. 1287. 10.3390/molecules30061287
15. Tarek A El-Adawy, Khaled M Taha. Characteristics and composition of different seed oils and flours, Food Chemistry, Volume 74, Issue 1, 2001, Pages 47-54.