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The Influence of Bioactive Compounds in Food Products

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Abstract: *Demand for healthy and nutritious food is growing worldwide. The aim is to produce food products that not only satisfy the need for food but also provide many nutritional benefits to the health of the consumer. The current study aims to produce a food product with high nutritional value. For this purpose, a fresh cow's milk cheese was fortified with grape powder. The amount of powder added was different, with 3 samples plus a control sample in which no powder was added. The resulting products were sensory analysed to determine consumer acceptability. The samples were also analysed physico-chemically and enzymatically, measuring pH, lactose and lactic acid content over a storage period of 14 days. Fresh cow's cheese samples with added grape powder obtained superior results compared to the control sample during the whole storage period. The grape powder added to fresh cow's cheese positively influenced the sensory and enzymatic characteristics of the finished product.*

Keywords: *fresh cheese, grape powder, bioactive compounds, sensory analysis, food products.*

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1. Introduction

For the future, food production must ensure healthy nutrition for the consumer in addition to ensuring the food requirement. (Jeyakumari, Zynudheen, & Parvathy, 2016). In 2019, the US Food and Agriculture Organization (FAO) estimated that in the near future agricultural production will be 70% higher than today (Ben Said, Gaudreau, Dallaire, Tessier, & Fliss, 2019).

It is very important that the foods of the future provide a balanced, healthy diet that ensures proper physical and mental health for consumers (Jeyakumari et al., 2016).

A major stress factor for both adults, teenagers and children is the situation generated by the COVID-19 pandemic (Costinescu, 2020; Luca et al, 2022) and the war in Ukraine.

Eliminating as much as possible the effects caused by pandemic stress involves adopting a healthier lifestyle, avoiding being sedentary and being as active as possible, thus avoiding the onset of anxiety or depression, cardiovascular and mental illnesses (Micu, 2020, Anghel et al, 2022).

Dairy products are very well consumed by almost all categories of consumers, and therefore their production in conditions as close as possible to the needs of consumers ensures their healthy evolution, also preventing a series of cardiovascular or obesity-related diseases (Tiţa, Constantinescu, Tiţa and Georgescu , 2020).

Cheese are food of high nutritional and biological value due to its content of proteins, lipids, mineral salts and vitamins, nutrients of very high quality and high bioavailability. For all types of cheese, there are several common features that need to be taken into account, but it is important to note that cheese is a nutritious and versatile food that can play an important role in a healthy and balanced diet (Segal, 2001).

Fresh cow's cheese is high in essential amino acids and proteins with high biological value. When made from skimmed milk, fresh cheese has a low-calorie content, but is a high protein food with high biological value in calcium and phosphorus, which recommends in the diet of segments of the population such as the elderly and the obese. It is easily digestible and this is important in therapeutic diets. With its lipotropic compounds - methionine and choline - fresh cow's cheese is particularly recommended for people with liver and gastrointestinal disorders (Segal, 2003).

Global grape processing in Europe results in a very large amount of by-products, namely skins, seeds and bunches (Chouchouli et al., 2013).

Grape skins are rich in anthocyanins and phenolic acids: ferulic, caffeic, syringic and p-coumaric gallic acid, elements with a relevant bioactive role. Therefore, the superior valorization of by-products from the wine industry, respectively grape juice, is a priority for the production of foods with high nutritional value and bioactive compounds can represent valuable functional ingredients in food (Dabija, 2018).

Pomace is a by-product of the winemaking process and is an important source of polyphenols (Anastasiadi et al., 2012; Ciubara et al, 2018). Polyphenols are active plant metabolites and are important constituents of a balanced diet. Intake of polyphenols is inversely proportional to the development or progression of chronic diseases. Polyphenols also bring benefits in the treatment of diabetes, hypertension, stress and anti-ageing benefits (Pandey & Rizvi 2010).

The antihypertensive effect of resveratrol has been demonstrated through its ability to produce vasodilation (Wu, et al. 2013; Wang, et al. 2006), thus lowering systolic blood pressure. Resveratrol prevents platelet aggregation, and reduces atheroma plaque formation, these largely contribute to atherosclerosis (Fernandez-Mar, et al. 2012).

The current study aims to produce a food product with high nutritional value. For this purpose, a fresh cow's milk cheese was fortified with grape powder. The amount of powder added was different, with 3 samples plus a control sample in which no powder was added. The resulting products were sensory analysed to determine consumer acceptability. The samples were also analysed physico-chemically and enzymatically, measuring pH, lactose and lactic acid content over a storage period of 14 days.

2. Materials and methods

2.1. Obtaining samples of fresh cow's cheese with added grape powder

- The cow's cheese samples came from milk from a farm in Sibiu County, Vulpăr commune. The farm has all the necessary accreditations for organic certification.
- Rennet - IDEAL liquid rennet from IDEAL STILL EXIM SRL was used for the production of fresh cow's cheese and stored at 2-4 °C until use.
- Grape skin powder - grape skins of the Fetească Neagră variety were used. The skins were removed from the berries, dried initially on the ML-50 thermobalance and then freeze-dried. The grape skin powder was stored at 2-4 °C until use.

The raw milk was initially heated to 70 °C and then cooled to 34 °C. When the cooling temperature was reached, liquid rennet was added in an amount of 1 ml per 5 l of milk. The seeded milk was kept for 90 minutes at room temperature for coagulation. After 90 minutes processing and pressing of the coagulum in a sieve with gauze to drain the whey took place. After draining the whey, grape skin powder is added. After several trials, three types of quantities were determined: 1g grape powder per 100g cheese sample, 2g grape powder per 100g cheese sample and 3g grape powder per 100g cheese sample. The fresh cheese was placed in 250g plastic containers and kept refrigerated at 4-6°C. During storage, the plastic containers with cheese samples were covered with food wrap.

2.2. Sensory analysis

The sensory analysis was carried out by a team of 9 tasters from the Research Center for Biotechnology and Food Engineering who regularly consume cheese. Tasting periods were on the first day of storage, the 7th day and the 14th day. To carry out the sensory analysis, the comparison method with unit score scales was used. In this method, the taster examines the sensory qualities of fresh cows' milk cheese with added grape powder by comparing it with unit score scales (from 0 to 5 points). For each sensory characteristic (color, firmness, taste, odor and viscosity) a scoring table was drawn up. The scores for the sensory characteristics are as follows:

- 5 points - very good;
- 4 points - good;
- 3 points - satisfactory;
- 2 points - unsatisfactory;
- 1 point - improperly
- 0 points - altered.

2.3. pH determination

The pH of fresh cows' cheese samples with grape powder was measured using an Orion 2 Star pH meter at 25°C. Three replicates were performed for each sample on each day of analysis, and the period of analysis was on day 1, day 7 and day 14 of sample storage.

2.4. Determination of lactose content

The working method and sample preparation were carried out according to the R-Biopharm Cat. No. 10 176 303 035 and IDF 79B (1991)

and ISO 5765-2 (1999). The absorbance was measured at 340 nm for each sample using the spectrophotometer model STAT FAX 1904.

2.5. Determination of L-lactic acid content

The working method and sample preparation were carried out according to the R-Biopharm Cat. No. 10 139 084 035 and ISO 69B (1987) and ISO 9069 (1986). The absorbance was measured at 340 nm for each sample using the spectrophotometer model STAT FAX 1904.

2.6. Statistical analysis

All data were expressed in terms of the following statistical indicators: mean value, median, standard deviation, maximum value, and minimum value. All statistical analyses were performed using Minitab version 14 software.

3. Results and discussions

3.1. Obtaining samples of fresh cow's cheese with added grape powder

Four samples of fresh cow cheese with added grape powder were made and numbered as follows (Figure 1):

- FCGP 1 - fresh cow's cheese with added grape powder (1g powder:100g cheese)
- FCGP 2 - fresh cow's cheese with added grape powder (2g powder:100g cheese)
- FCGP 3 - fresh cow's cheese with added grape powder (3g powder:100g cheese)
- CS - control sample

Figure 1. Fresh cow's cheese with added grape powder
Source: Authors' personal colection

3.2. Sensory analysis

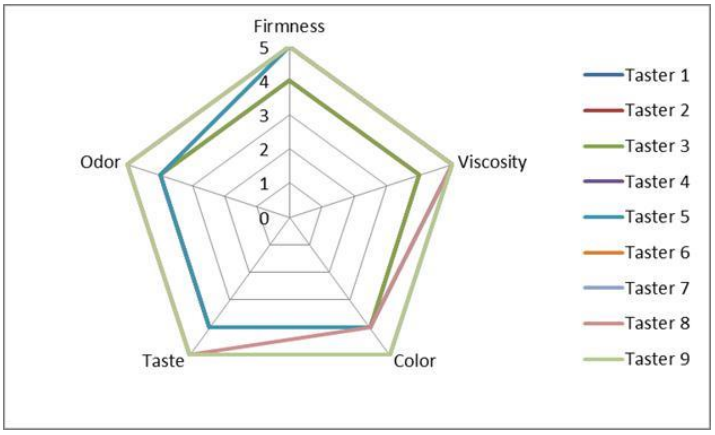

Figure 2. Evaluation of the characteristics of fresh cow's cheese with added grape powder (1g:100g) on the first day of storage
Source: Authors' personal colection

Figure 2 shows the evaluation of the characteristics of fresh cow's cheese with added grape powder (1g:100g) on the first day of storage. On the first day of storage, for sample FCGP1 the most appreciated characteristics were firmness and viscosity, obtaining 6 marks out of 5, followed by taste which obtained 4 marks out of 5. The least appreciated was color, obtaining only 3 marks out of 5.

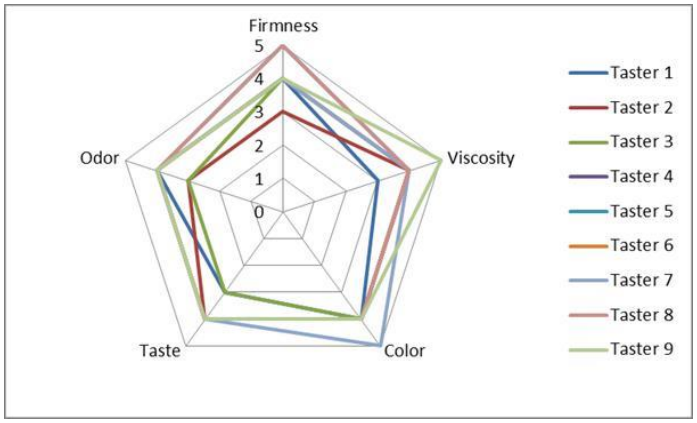

Figure 3. Evaluation of the characteristics of fresh cow's cheese with added grape powder (1g:100g) on the 7th day of storage
Source: Authors' personal colection

Figure 3 shows the evaluation of the characteristics of fresh cow's cheese with added grape powder (1g:100g) on the 7th day of storage. On day 7 of storage, the most appreciated characteristic of sample FCGP1 was firmness, obtaining two scores of 5. The least appreciated characteristics were taste and smell, with no score of 5.

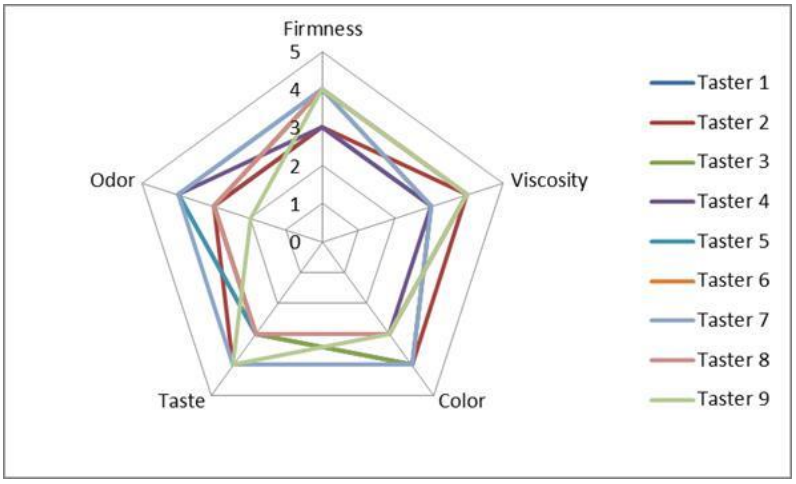

Figure 4. Evaluation of the characteristics of fresh cow's cheese with added grape powder (1g:100g) on the 14th day of storage

Figure 4 shows the evaluation of the characteristics of fresh cow's cheese with added grape powder (1g:100g) on the 14th day of storage. On the 14th day of storage, the most appreciated characteristic of sample FCGP1 was firmness, which received six marks out of 4, and the least appreciated was color, which received three marks out of 4.

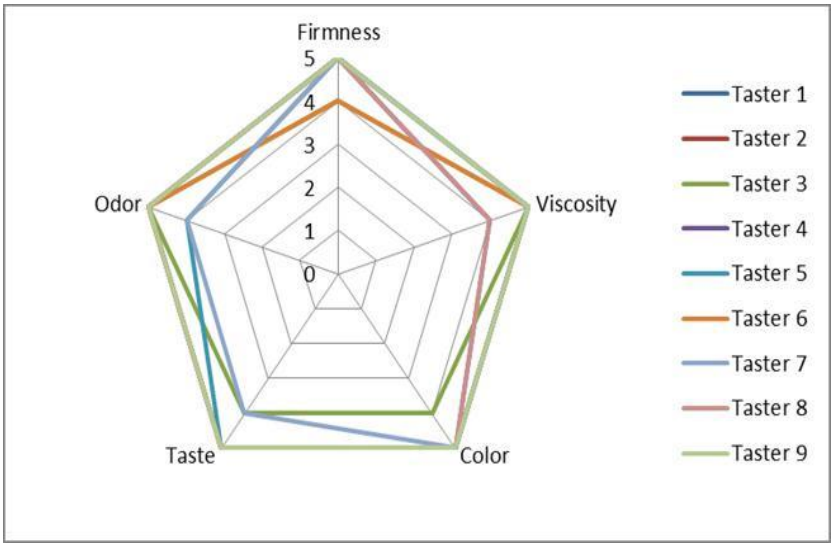

Figure 5. Evaluation of the characteristics of fresh cow's cheese with added grape powder (2g:100g) on the first day of storage
Source: Authors' personal collection

Figure 5 shows the evaluation of the characteristics of fresh cow's cheese with added grape powder (2g:100g) on the first day of storage. On the first day of storage, the most appreciated characteristics of sample FCGP2 are firmness, odor, viscosity and color. The least appreciated was the taste.

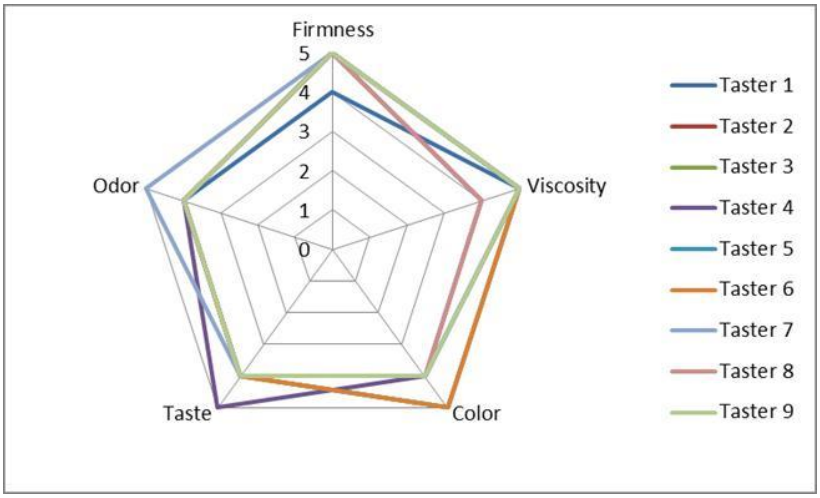

Figure 6. Evaluation of the characteristics of fresh cow's cheese with added grape powder (2g:100g) on the 7th day of storage
Source: Authors' personal collection

Figure 6 shows the evaluation of the characteristics of fresh cow's cheese with added grape powder (2g:100g) on the 7th day of storage. On the 7th day of storage, the most appreciated characteristic is firmness, with eight scores of 5. The least appreciated were taste and smell, which were given only one mark of 5.

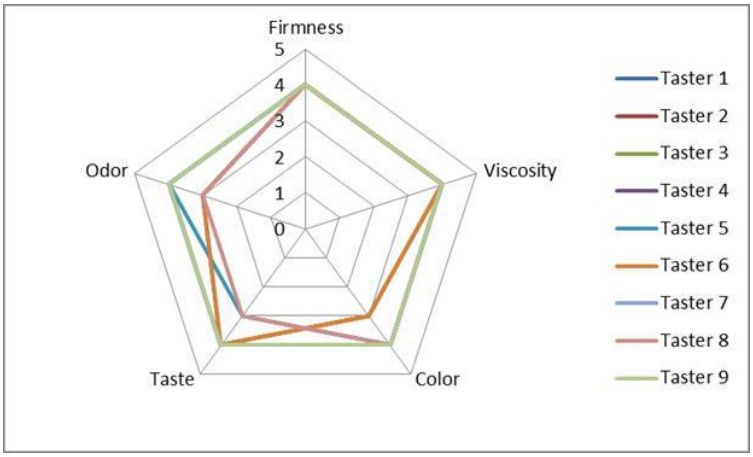

Figure 7. Evaluation of the characteristics of fresh cow's cheese with added grape powder (2g:100g) on the 14th day of storage
Source: Authors' personal colection

Figure 7 shows the evaluation of the characteristics of fresh cow's cheese with added grape powder (2g:100g) on the 14th day of storage. On the 14th day of storage, the most appreciated characteristic is firmness, with nine scores of 4. The least appreciated were taste and odor, which received six marks out of 4.

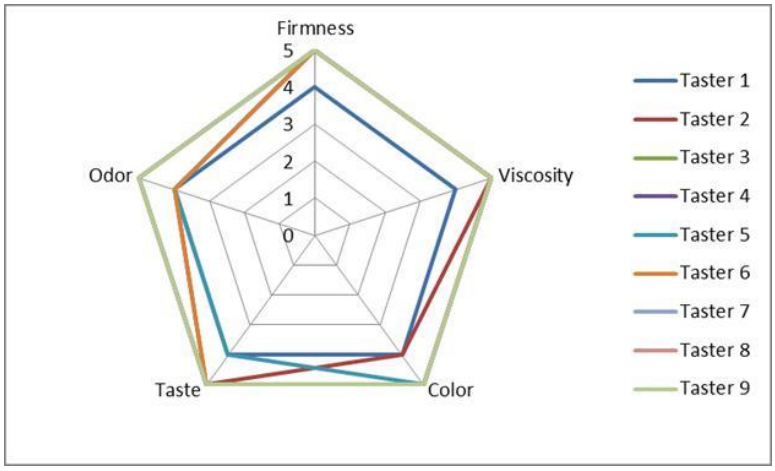

Figure 8. Evaluation of the characteristics of fresh cow's cheese with added grape powder (3g:100g) on the first day of storage
Source: Authors' personal collection

Figure 8 shows the evaluation of the characteristics of fresh cow's cheese with added grape powder (3g:100g) on the first day of storage. On the first day of storage, the most appreciated characteristics of sample FCGP3 were firmness and viscosity, both of which scored 8 out of 5. The least appreciated characteristic was odor.

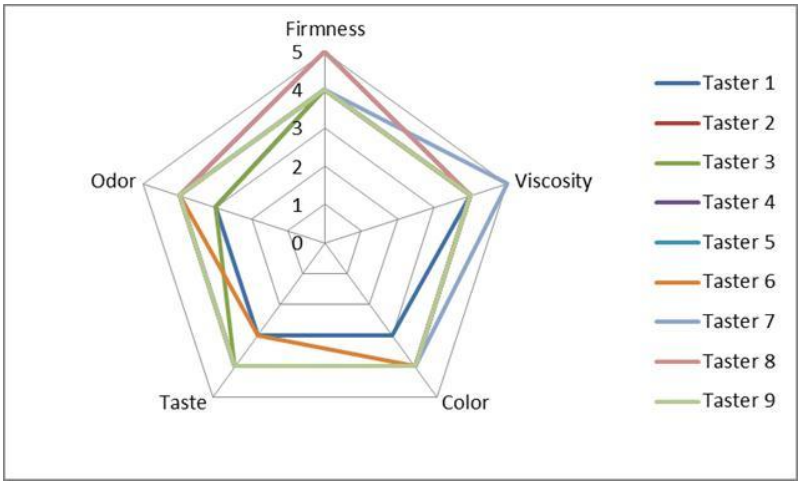

Figure 9. Evaluation of the characteristics of fresh cow's cheese with added grape powder (3g:100g) on the 7th day of storage
Source: Authors' personal collection

Figure 9 shows the evaluation of the characteristics of fresh cow's cheese with added grape powder (3g:100g) on the 7th day of storage. On the 7th day of storage, the most appreciated characteristics of sample FCGP3 are firmness and viscosity, obtaining two scores of 5. The least appreciated characteristics are odor and color.

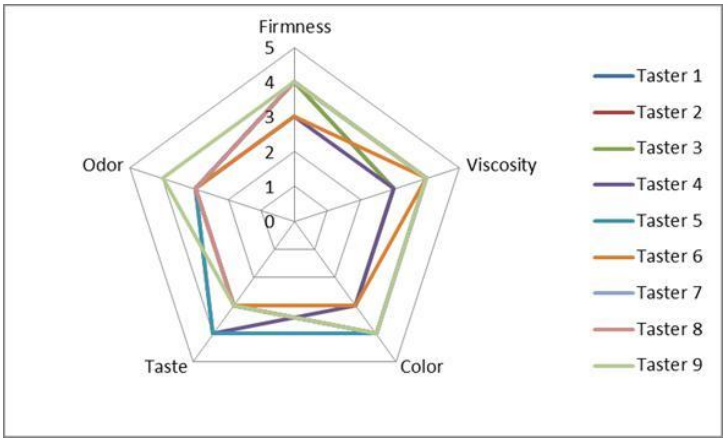

Figure 10. Evaluation of the characteristics of fresh cow's cheese with added grape powder (3g:100g) on the 14th day of storage
Source: Authors' personal colection

Figure 10 shows the evaluation of the characteristics of fresh cow's cheese with added grape powder (3g:100g) on the 14th day of storage. On day 14, the most appreciated characteristic of sample FCGP3 is firmness and the lowest is odor.

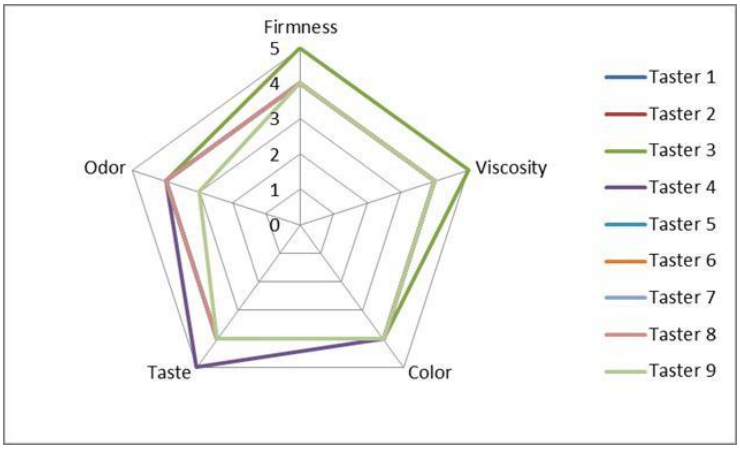

Figure 11. Evaluation of the characteristics of the control sample on the first day of storage
Source: Authors' personal collection

Figure 11 shows the evaluation of the characteristics of the control sample on the first day of storage. On the first day of storage of the control sample, the most appreciated characteristics were firmness, viscosity and taste, all receiving a score of 5. The least appreciated characteristic was odor, which even received a score of 3.

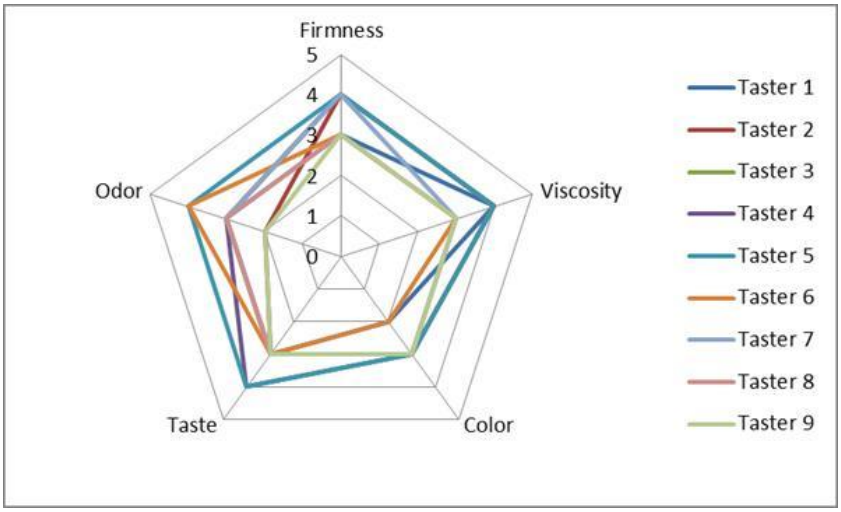

Figure 12. Evaluation of the characteristics of the control sample on the 7th day of storage
Source: Authors' personal colection

Figure 12 shows the evaluation of the characteristics of the ontrol sample on the 7th day of storage. On the 7th day of storage, the most appreciated characteristics of the control sample were firmness and viscosity, which received five scores of 4. The least appreciated characteristics were color and odor, which received three scores of 2.

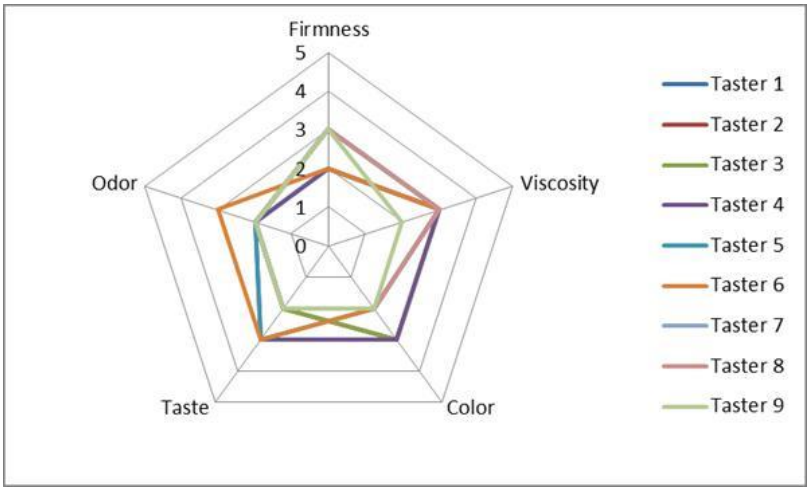

Figure 13. Evaluation of the characteristics of the control sample on the 14th day of storage
Source: Authors' personal colection

Figure 13 shows the evaluation of the characteristics of the control sample on the 14th day of storage. On the 14th day of storage, the control sample received the lowest marks, with no marks of 4 or 5.

The highest scores were obtained for the fresh cheese sample with added grape powder (2g:200g). This sample was rated highest in all three analysis periods. The control sample obtained the lowest scores in all three days of analysis.

3.3. pH determination

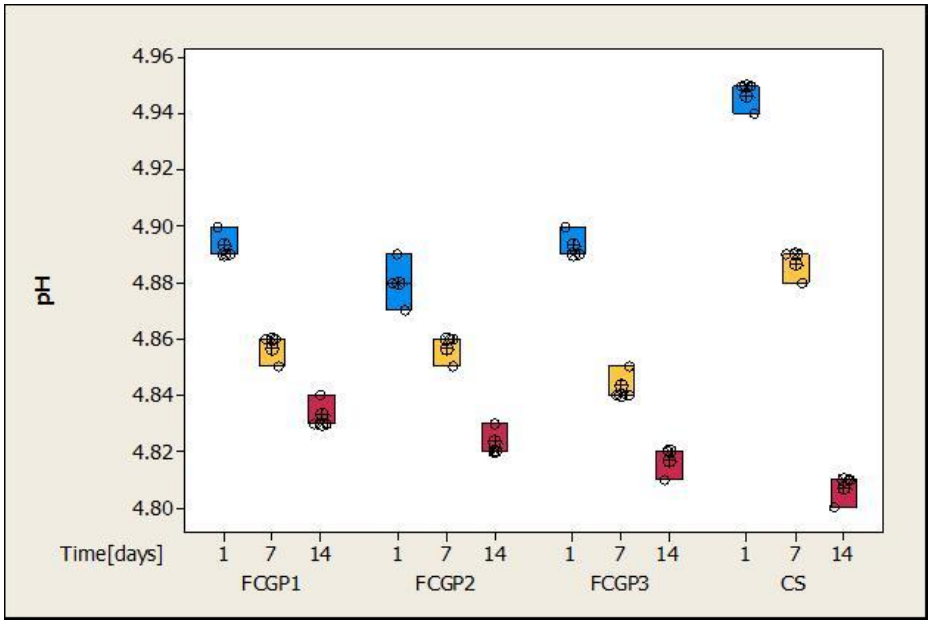

Figure 14. pH variation of the four samples of fresh cows' cheese with grape powder on day 1, day 7 and day 14
Source: Authors' personal colection

Figure 14 shows the pH variation of the four samples of fresh cows' cheese with grape powder on day 1, day 7 and day 14. On the first day of storage, the highest mean pH value was in sample CS (4.9467±0.0057) and the lowest pH value was in FCGP2 (4.88±0.01). On day 7 of storage, CS also has the highest mean pH value (4.8867±0.0057) and the lowest mean value is FCGP3 (4.8433±0.0057). On day 14 of storage, FCGP1 has the highest average pH value (4.8333±0.0057) and the lowest average value is CS (4.8067±0.0057).

3.4. Determination of lactose content

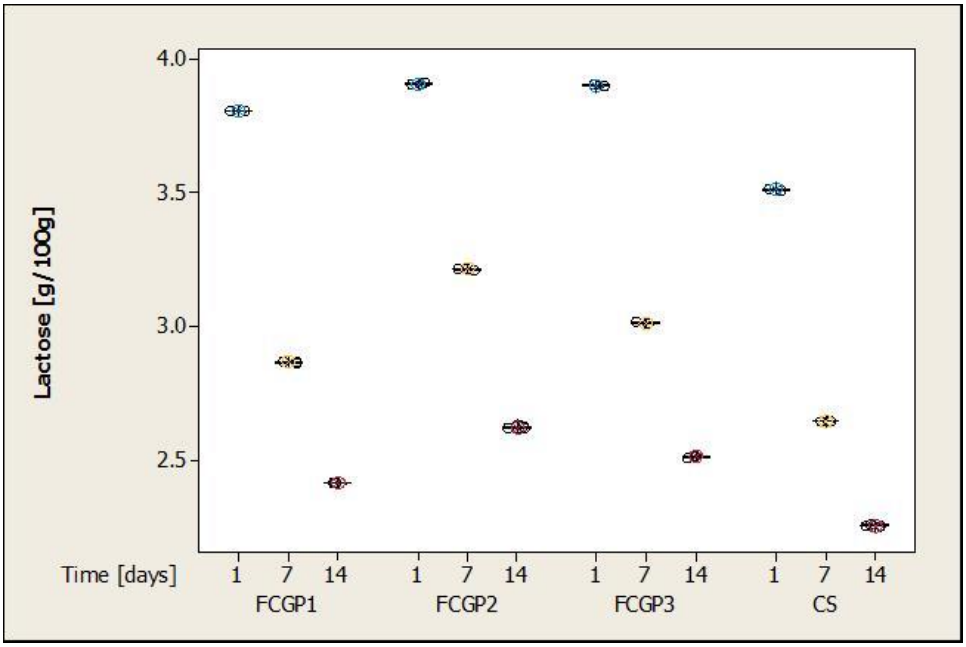

Figure 15. Variation in lactose content of the four samples of fresh cows' cheese with grape powder on day 1, day 7 and day 14
Source: Authors' personal colection

Figure 15 shows the variation in lactose content of the four samples of fresh cows' cheese with grape powder on day 1, day 7 and day 14. On the first day of storage, the highest average value of lactose content is for FCGP2 (3.9113±0.00153) and the lowest is for CS (3.5157±0.00321). On the 7th day of storage, the highest average value of lactose content is for FCGP2 (3.2153±0.00115) and the lowest is for CS (2.6453±0.00252). On the 14th day of storage, FCGP2 recorded the highest average lactose content (2.6243±0.00153), and the lowest is for CS (2.2557±0.00208).

3.5. Determination of L-lactic acid content

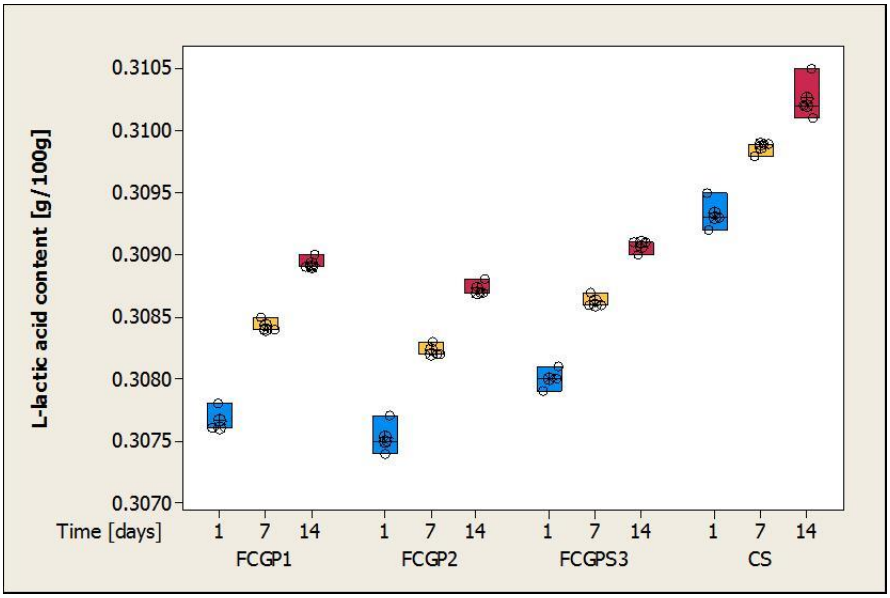

Figure 16. Variation in L-lactic acid content of the four samples of fresh cows' cheese with grape powder on day 1, day 7 and day 14
Source: Authors' personal colection

Figure 16 shows the variation in L-lactic acid content of the four samples of fresh cows' cheese with grape powder on day 1, day 7 and day 14. On the first day of storage, the highest average value of L-lactic acid content is for CS (0.30933±0.000153), and the lowest average value is for FCGP2 (0.30753±0.000153). On day 7 of storage, the highest value of L-lactic acid content is for CS (0.30987±0.0000577) and the lowest value is for FCGP2 (0.30823±0.0000577). On day 14 of storage, CS has the highest mean value of L-lactic acid content (0.31027±0.000208) and FCGP2 has the lowest mean value (0.30873±0.0000577).

4. Conclusions

The regular consumption of dairy products ensures a balanced and beneficial diet for the normal development of consumers, preventing the occurrence of cardiovascular diseases.

The aim of this study was to obtain a dairy product, namely fresh cow's cheese with grape powder, which represents a product with a high nutritional value. The grape powder was obtained from grape skins, Fetească

Neagră variety and it contains several compounds with antioxidant properties, the best known being resveratrol.

Three samples of fresh cow's milk cheese with added grape powder with different compositions and a control sample, i.e. fresh cow's milk cheese without added grape powder, were made.

Following the sensory analysis it was concluded that the highest scores were given to the cheese sample with the addition of 2g of grape powder per 100g of product. For the other analyses performed, pH, lactose and lactic acid content, the results were superior to the control sample. The results of these analyses were statistically processed using the MINITAB 14 program.

From the analytical and sensory results obtained we can conclude that the grape powder added to the fresh cow's cheese had a positive influence on the finished product improving the sensory characteristics of the product.

The creation of such products is in full agreement with the current trends to obtain food products with high nutritional value by incorporating bioactive components capable of ensuring a balanced and healthy diet, respecting the requirements of the environment and applying a sustainable circular economy.

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