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APPLICATION OF PUMPKIN PROTEIN CONCENTRATE IN THE PRODUCTION OF YOGURT BASED ON OATS

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Abstract. *Oats and new oat-based products, as part of a healthy diet, are becoming increasingly popular in the market of functional food. Accordingly, using the health benefits of probiotic culture with oat prebiotic beta-glucan, the aim of the paper was to try to develop a recipe for the production of a sensory and rheologically acceptable fermented non-dairy product based on oats, with the use of pumpkin protein concentrate (P), vanilla flavor extract (V) and blended cherries (CH). The oat bran suspension was fermented with a mixed starter culture containing Streptococcus thermophilus, Lactobacillus bulgaricus and Bifidobacterium bifidum. The oat base was heat treated for 10 minutes at 80°C and cooled to 37°C for the inoculation process. In addition to the control sample (C) without supplements, samples were also produced with the following combinations: 1%P, 1%P+1%V, 1%P+3%CH, 1%P+5%CH and 1%P+ 7%CH. When monitoring the drop in pH value, the fermentation lasted 6 hours. During the 1st, 7th and 14th days of storage, active acidity, viscosity and syneresis were measured for all samples, while the sensory evaluation (taste, consistency, color, smell and appearance of the surface) was evaluated by a panel group of 3 members. On the 1st storage day, a test of acceptability and desirability was conducted using a verbal hedonic scale by 32 subjects who had not been tested previously, and who expressed a general impression of the researched products with grades from 1 to 9. The results showed that the fermentation of the samples with the addition of sour cherries in all concentrations was completed in 5 hours, while the other samples fermented in 7 hours. Also, during the entire storage time, syneresis was statistically significantly higher, and viscosity was lower ($p<0.05$) in samples with added cherry (1%P+3%CH, 1%P+5%CH and 1%P+ 7%CH) compared to other samples (C, P and CH). The best sensory evaluations, of all produced yogurt samples, were after the 1st day of evaluation, with the fact that the group of samples with cherry received slightly lower evaluations due to the poorly evaluated parameters of taste and consistency. On the 14th storage day, samples C, P and CH maintained their maximum scores, while samples with cherry showed fluffy accumulations on the surface, which indicated signs of spoilage and these samples were eliminated from further analysis.*

Key words: *oat-based yogurt, recipe, fermentation, durability*

Introduction

Fermented drinks, i.e. fermented milks of plant origin, with numerous positive effects on human health, have recently been one of the most important products in the functional food category [1]. They are the first choice of milk substitute and milk products, especially for people who are sensitive to certain milk components, such as

milk protein allergies and lactose intolerance [2]. On the other hand, fermented beverages of plant origin can serve as an alternative for people who follow a vegan diet, as well as for people who are more and more aware of a healthy way of eating with the lowest possible calorie intake. Oat drinks are certainly one of the most representative plant-based foods, which are rich in nutrients and functional properties and they are an excellent substitute for traditional dairy products. They are also a valuable source of high-quality proteins with a good balance of amino acids [3] and a favorable composition of unsaturated fats (oleic and linoleic) [4]. The main health effects of oats are attributed to their high β-glucan content [5], which has been proven to lower blood cholesterol and intestinal glucose absorption (EFSA, 2010), thereby preventing diseases such as cardiovascular, hypertension, inflammatory conditions, colon cancer and type 2 diabetes [5,6,7]. In addition, oats are suitable for people suffering from celiac disease because they do not contain gluten [8,9]. Oats also contain numerous bioactive compounds such as phenolic compounds that have antioxidant effects [8]. Another important role of β-glucan is its prebiotic function in the gastrointestinal tract, supporting the growth of beneficial microbial groups. However, despite the beneficial effect on health, herbal drinks (including oat milk) have certain disadvantages compared to milk of animal origin. Thus, for example, the nutritional value of these drinks is reduced [10], mostly due to the lower proportion of protein, as well as the lower bioavailability of mineral substances. However, one of the biggest drawbacks of these products is the fact that fermented oat milk by itself cannot form a gel network analogous to that found in traditional yogurt, which gives oat yogurt a poorer sensory and textural quality. Therefore, in order to eliminate these defects, herbal drinks can be enriched by adding various ingredients such as aromatic substances, sugar, mineral substances and the like. In addition, in order to improve the nutritional value, plant proteins can be added in the form of concentrates and isolates and starter cultures that will carry out the fermentation process in order to obtain a drink similar to yogurt.

The aim of this paper was to produce a drink based on whole grain oatmeal with the addition of pumpkin protein concentrate, vanilla flavor extract and blended cherry, so that the finished product has the appropriate appearance, color, consistency, smell and taste and will be a suitable substrate for fermentation with lactic acid bacteria. In addition, the purpose was to monitor the course of fermentation, and to determine active acidity, rheological properties (syneresis and viscosity) during storage, and sensory analysis, on the basis of which the durability of these products will be assessed.

Material and methods

Materials

-Oatmeal, H&J. BRÜGGEN KG Lübeck, Germany (fat 7%/saturated fat 1.3%, carbohydrates 58.7%/sugars 0.7%, protein 13.5%, fiber 10.0%, salt 0.02%).
-Pumpkin protein concentrate, FAN-Comerce d.o.o., Visoko, Bosnia and Herzegovina (proteins 62%, 12% fat/saturated fat 2.3%, carbohydrates 7%sugar 4.2%, fiber 13.2%, salt 2.04%)

-Vanilla extract ETERIKA d.o.o. Trstenik, Serbia (aroma 20%, propylene glycol 28%, ethyl alcohol 12%, demi water 40%)
-Frozen cherry "ag frigo" Delta Trade d.o.o., Delta Frost, Zenica, Bosnia and Herzegovina (fats 0.2%/ saturated fats 0.1%, carbohydrates 21.9%/ sugars 12.2%, proteins 1.2 %, salt 0.0g)

Culture

A probiotic thermophilic culture Bifidobacterium (nu-trish® BB-12®) from Chr. Hansen (Hoersholm, Denmark) in a concentration of 1.5%, was used.

Yogurt Manufacturing

Six experimental samples of yogurt were prepared from oat milk (C) and oat milk with the addition of: pumpkin protein (1%P), flavored vanilla extract (1%P+1%V) and with the addition of different concentrations of blended cherries (1%P+ 3%CH, 1%P+5%CH and 1%P+7%CH). Oat milk was previously prepared by adding 400 g of oats to a container filled with up to 3 L of water. The resulting suspension was manually mixed for 1 minute and filtered through sterile gauze. The milk thus extracted was divided into 6 Erlenmeyer flasks and pasteurized at 80°C for 10 min in a water bath. After cooling to 50°C, the samples were supplemented with the already mentioned additives. Then the milk was cooled to 37°C and inoculated with a 0.005g/l probiotic culture of Bifidobacterium (nu-trish® BB-12®). The samples were further divided into cuvettes for syneresis and cups for measuring viscosity, and fermentation was carried out (37°C) for 6 hours. After fermentation, the samples were quickly cooled to 20°C and placed in a refrigerator at 5°C ±1. Samples for analysis were taken after the 1st, 7th and 14th day of storage. Each test was repeated 3 times, i.e. 7 times for viscosity.

The experimental design and product code are presented in Table 1.

Table 1. Codes of different yogurt mixes present in this study

Code	Treatment
C	Control yogurt
1%P	Yogurt with 1.0% of pumpkin protein concentrate (10g kg^{-1} P)
1%P+1%V	Yogurt with 1.0 % of pumpkin protein concentrate (1.0 % (10g kg^{-1} P) and vanilla extract 1.0 % (10g kg^{-1} V)
1%P+3%CH	Yogurt with 1.0% of pumpkin protein concentrate (10g kg^{-1} P) and 3.0 % cherry (30g kg^{-1} CH)
1%P+5%CH	Yogurt with 1.0% of pumpkin protein concentrate (10g kg^{-1} P) and 5.0 % cherry (50g kg^{-1} CH)
1%P+7%CH	Yogurt with 1.0% of pumpkin protein concentrate (10g kg^{-1} P) and 7.0 % cherry (70g kg^{-1} CH)

Methods of Analysis

-After manufacturing, yogurt samples were analyzed by measuring pH value during fermentation and over 14 days of storage. The pH value was measured with a laboratory pH meter (pH HI2002 Meter, HANNA Instruments, USA).
-Viscosity was measured using a Brookfield DV-E viscosimeter (Brookfield Engineering Laboratories, Stoughton, MA, USA). The viscometer was operated at 20 rpm (spindle #4). Each result was recorded in mPa·s after a 30 s rotation, during 3 min.
-Centrifufe SIGMA 2-6 Laboratory Centrifuges (Osterode, Germany) was used to determine syneresis (modified method by Keogh and O'Kennedy, [11].The samples were centrifuged at 3000 rpm for a period of 10 minutes. After centrifugation, the mass of remaining sediment was determined and based on this value, the separated serum mass was calculated. The percentage isolated serum is calculated by the formula:

$$\% (w/w) = (mK - mT) / mM \times 100$$, where is:

mK - mass of cuvette with substance;
mT -mass of remaining sediment after centrifugation;
mM - mass of substance (yogurt) in the cuvette

Sensory evaluation of yogurt was profiled after the 1st, 7 st and 14th day in the cold store. The sensory properties of yogurt were evaluated by 3 trained panellists using the International Dairy Federation (IDF) method [12]. The sensory attributes consisted of flavour, odour, general appearance, colour and consistency, and the coefficients of significance (Fv) were: 2.4 for taste; 0.4 for odour; 0.2 for appearance and for colour and 0.8 for consistency. Maximum score was 20, and the sensory scores were awarded for each attribute using a rating scale ranging between 1-5.

Determining the acceptability of yogurt was examined by 32 tasters using the verbal hedonic scale according to (Stone and Siedl, 1985) [13] with nine possible answers, i.e., tasters are rated from 9 to 1 (9-extremely highly desirable, 8-highly desirable, 7-moderately desirable, 6-slightly desirable, 5-neutral, 4-slightly undesirable, 3-moderately undesirable, 2-highly undesirable and 1-extremely highly undesirable) expressed a general impression of the researched product. Samples awarded scores of less than 7 are not considered acceptable. Yogurt acceptability testing was conducted on the 1st day of storage. Based on desirability ratings for individual variations, the sum (Σ), average ($\overline{X}$), standard deviation (SD), coefficient of variation (CV), and percentage (P) of sample acceptability were calculated.

Statistical analysis

Data were analyzed using two-way analysis of variance using Tykey's test to compare means at the 95% confidence level (IMB SPSS Statistics 26, Chicago, Illinois USA) and Microsoft Excel 2016. The values of different tests are expressed as mean values ± standard deviation ($\overline{X} \pm SD$).

Results and discussion

The produced oat milk was used as the primary ingredient to develop the yogurt formulation following the standard steps involved in yogurt production, and the pumpkin protein concentrate was supposed to serve as an additive to improve the consistency and texture of the finished product.

pH during fermentation and sample storage

Acidity is a very important parameter in the production of fermented beverages of plant origin in order to achieve the greatest similarity with yogurt.

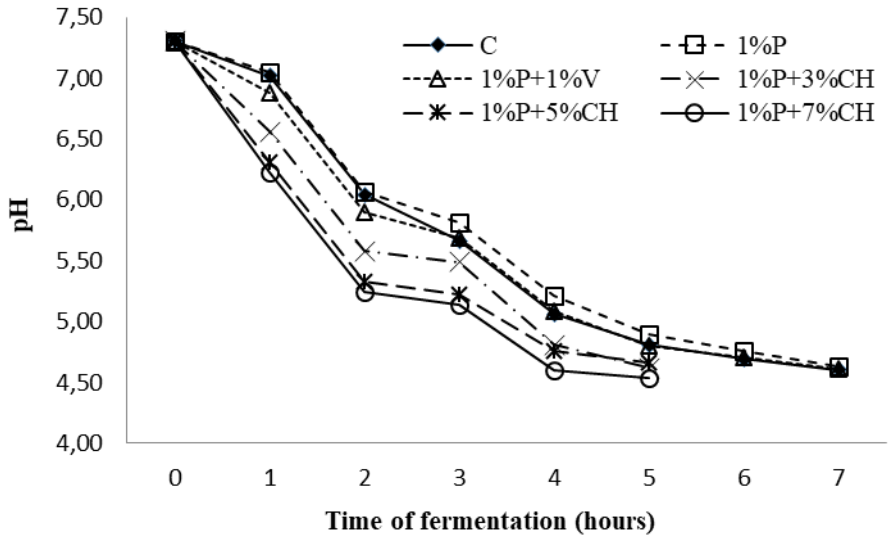

Figure 1. Changes in pH during the fermentation of oat yogurt enriched with pumpkin protein concentrate (P), vanilla flavor (V) and different concentrations of blended cherry (CH).

All samples prepared for the production of oat yogurt were subjected to fermentation until a pH of approximately 4.6 was achieved (Figure 1). The sour cherry samples were fermented in 5 hours and achieved the following results: 4.36 for the 1%P+7%CH sample, 4.47 for the 1%P+3%CH sample and 4.51 for the 1%P+5% sample CH. After 7 hours of fermentation, the control sample (C) had a pH value of 4.69, the sample with 1%P+1%V 4.7, while the highest value was achieved by the sample with 1%P, 4.76. The different fermentation rates can be attributed to the different composition of the starting fermentation medium. The results of Angelova et al. [14], who fermented oat milk with lactic acid bacteria *Lactobacillus plantarum* with the addition of sucrose in different concentrations, showed that the optimal time for lactic acid formation is 8 h. A similar time of 7.38 h to reach a pH of 4.5 was achieved by Masiá et al. (2020) [15], who produced an oat drink with a starter culture containing *Streptococcus thermophilus*, *Lactobacillus bulgaricus*, *Lactobacillus acidophilus*, *Lactobacillus paracasei* and *Bifidobacterium* sp. and with a supplement containing sucrose and starch. On the other hand, in research by Mårtensson et al.

[16], (2002), who inoculated oat drink with different probiotic strains (*Lactobacillus reuteri*, *Lactobacillus acidophilus* and *Bifidobacterium bifidum*) in combination with yogurt culture, the results showed a fermentation duration of up to 16 h. Another example of longer fermentation of oat drink is in the research of Luana et al. (2014) [17] which lasted 12 hours during which the pH dropped from 6.45 to 4.23. On the first day of storage (Figure 2), the sample with 1%P had the highest pH value of 4.42, followed by the C sample (4.41), then the samples with 1%P+1%V (4.36) and with 1 %P+7%CH (4.34). The samples with 1%P+3%CH (4.28) and with 1%P+5%CH (4.25) had the lowest pH values. For all beverages, it can be said that there was little or no drop in pH value during the first 7 days of storage, as well as on the 14t^{h} day of storage for samples C, 1%P and 1%P+1%V. Similar results of oat fermented beverages were reported by Gupta et al. (2010) [18] where during the 21st day of storage there was no significant change in pH, which was 4.5. However, in these studies, the samples with sour cherries (1%P+3%CH, 1%P+5%CH and 1%P+7%CH) showed signs of deterioration on the 14t^{h} day, and the pH value was not measured.

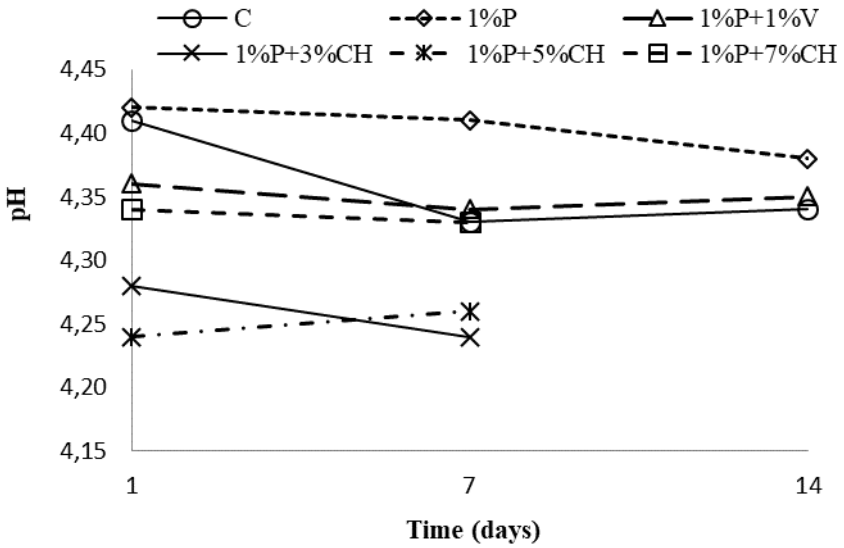

Figure 2. Changes in pH during 14 days of storage of oat yogurt enriched with pumpkin protein concentrate (P), vanilla flavor (V) and different concentrations of blended cherry (CH).

Rheological properties of the product

Viscosity

During the development of new products, viscosity plays a major role in defining the texture and generally achieving the desired sensory properties. According to Sobiechowska et al. [19] raw materials rich in fiber (β-glucan in oats) contribute to the viscosity of the final product due to their ability to create viscous solutions.

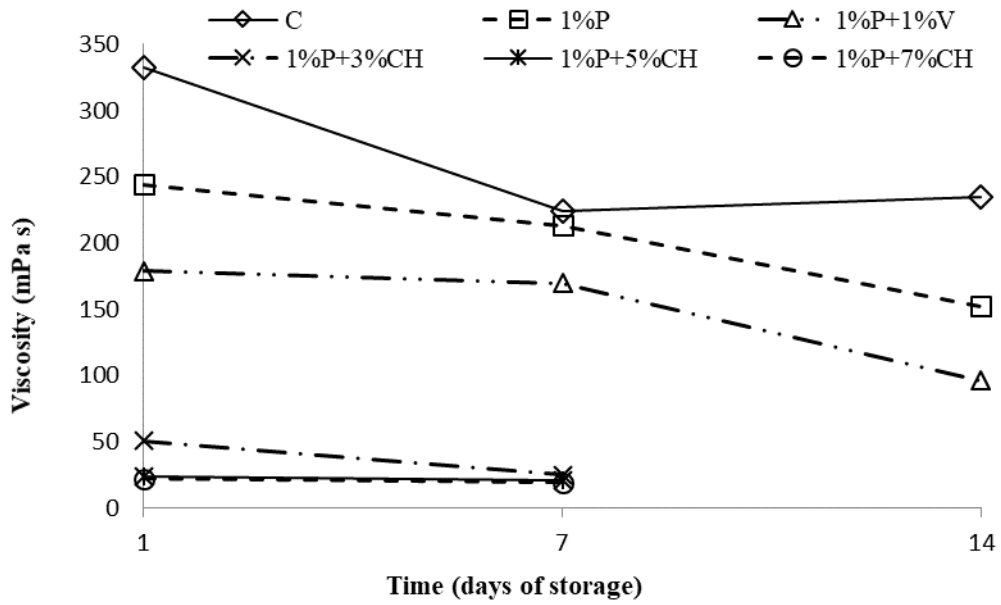

Figure 3. Changes in viscosity values during storage of oat yogurt enriched with pumpkin protein concentrate (P), vanilla flavor (V) and different concentrations of blended cherry (CH).

Table 2. Analysis of variance with two factors of variability (Two-Way Analysis of Variance - ANOVA) of data for oat yogurt in Figure 3.

Groupe of samples	N	Days		
		1	**7**	**14**
C	7	332.04^{aA}	224.42^{aB}	234.49^{aB}
1%PM	7	244.09^{bA}	213.42^{aB}	152.08^{bC}
1%PM+1%V	7	179.11^{cA}	169.56^{bA}	96.31^{cB}
1%PM+3%CH	7	50.88^{dA}	25.22^{cB}	
1%PM+5%CH	7	24.34^{eA}	20.52^{cA}	
1%PM+7%CH	7	22.26^{eA}	19.39^{cAB}	

^{abcde}different small letters indicate a statistically significant difference between different samples on the same storage day (Tukey's test**,** $p<0.05$)
^{ABC}different capital letters indicate a statistically significant difference between the same samples on different storage day (Tukey's test, $p<0.05$)

Figure 3 and Table 2 show the dependence of the viscosity (mPa·s) of oat drink samples on different additives and storage time.

On the 1st day of measurement, the results showed that there is a statistically significant difference ($p<0.05$) between individual samples, except for samples with 1%PM+5%CH and 1%PM+7%CH. The highest value of viscosity was shown by the C sample, followed by the sample with 1%PM and 1%PM+1%V. The addition of blended cherries in different concentrations led to a sudden decrease in viscosity in those samples. After 14 days of storage, a statistically significant decrease in viscosity

($p<0.05$) was observed for sample C and samples with 1%PM and 1%PM+1%V, while the ratio between individual measured samples remained approximately the same compared to day 1. Samples with 1%PM+3%CH, 1%PM+5%CH and 1%PM+7%CH showed signs of deterioration and no measurements were performed. It can be concluded that the addition of pumpkin protein concentrate at a concentration of 1%, as well as the presence of other additives, did not improve the viscosity compared to the control sample, moreover, there was a decrease in viscosity. The obtained results do not match the results of the research by Gupta et al. [18] in which the viscosity values of the fermented oat drink were much higher (1000 mPa·s) and there were no significant changes during 21 day of storage. These discrepancies can be attributed to the different amounts of added ingredients and consequently to the different proportions of water and dry matter of these products.

Syneresis

Syneresis is one of the parameters used to determine the quality of fermented products and the water retention capacity of the formed gel.

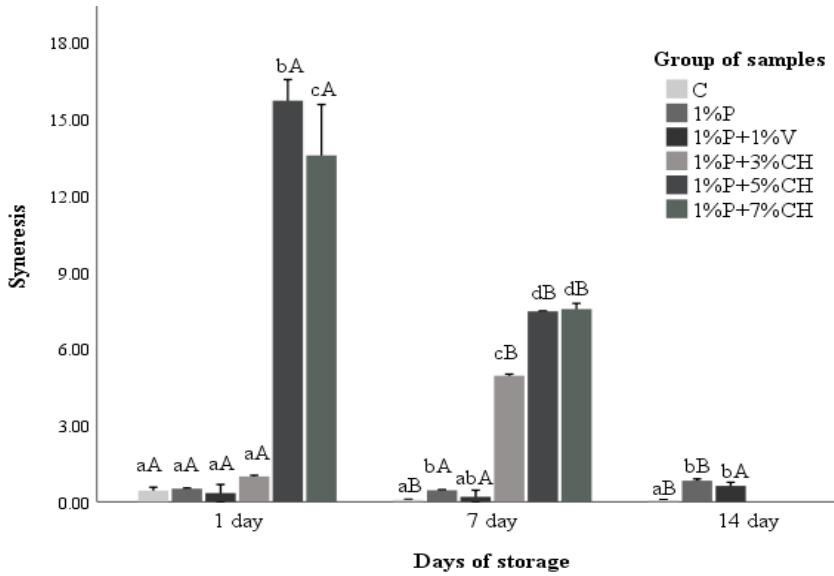

Figure 4. Syneresis results of oat yogurt enriched with pumpkin protein concentrate (P), vanilla flavor (V) and different concentrations of blended cherry (CH) after 14 days of storage

[abcde]different small letters indicate a statistically significant difference between different samples on the same storage day (Tukey's test, $p < 0.05$)
[ABC]different capital letters indicate a statistically significant difference between the same samples on different storage days (Tukey's test, $p< 0.05$)

Data on syneresis of prepared oat yogurt samples with different additives are shown in Figure 4. On the first day of measurement, syneresis was very small and amounted to 0.43, 0.51, 0.34 and 0.99% for samples C, 1%PM, 1%PM+1%V and 1%PM+3%CH, respectively. However, the addition of blended cherry in a

concentration of 5 and 7% led to a statistically significant increase in syneresis ($p<0.05$) compared to the previously mentioned samples. Also, there is a statistically significant difference in syneresis between the samples with 1%PM+5%CH and 1%PM+7%CH whose values of separated liquid were 15.72 and 13.57%. The increase in syneresis with the addition of blended cherry contradicts the results of Al-Sahlany et al. [20] whose results showed that increasing the concentration of date juice reduces syneresis. According to these authors, this can be attributed to the high fiber content found in date juice, with an increase in the concentration of which increases the ability to hold water, i.e. reduces syneresis. On the 7th and 14th days of storage, samples C, 1%PM and 1%PM+1%V maintained their stability and there was no significant change in syneresis. Samples with 1%PM+5%CH and 1%PM+7%CH showed a lower rate of syneresis on day 7 of storage compared to day 1, however on day 14 the samples showed signs and no measurements were made.

Sensory analysis of the product

Sensory analysis (Figure 5) was conducted by panelists who evaluated the appearance, color, consistency, flavor and odour of samples of fermented oat drinks with different additives (experimental design and code in Table 1). Samples C, 1%PM and 1%PM+1%V received the maximum marks and a total of 20 points for all analyzed sensory properties during the entire storage time of the 14th day. With the addition of 1%PM or 1%PM+1%V, the resulting gels retained a gentle consistency, homogeneous and compact structure compared to the C sample, which was reflected in the low syneresis and relatively high viscosity of these samples. The sample with 1%PM+1%V had a particularly pleasant aroma. Samples that had different proportions of cherry in their composition (1%PM+3%CH 1%PM+5%CH and 1%PM+7%CH), on the 1st and 7th days of storage, received the maximum marks for appearance properties, color and smell. However, due to the weaker consistency of the gel and the more sour taste, the sensory evaluations of these samples in the overall score were slightly lower (18.80, 18.65 and 17.60 on the 1st day and 18.20, 17.56 and 17.50 on the 14th day of storage, for the samples containing 3, 5 and 7% cherries, respectively). On the 14th day of storage, samples with sour cherries showed signs of spoilage and no sensory analysis was performed.

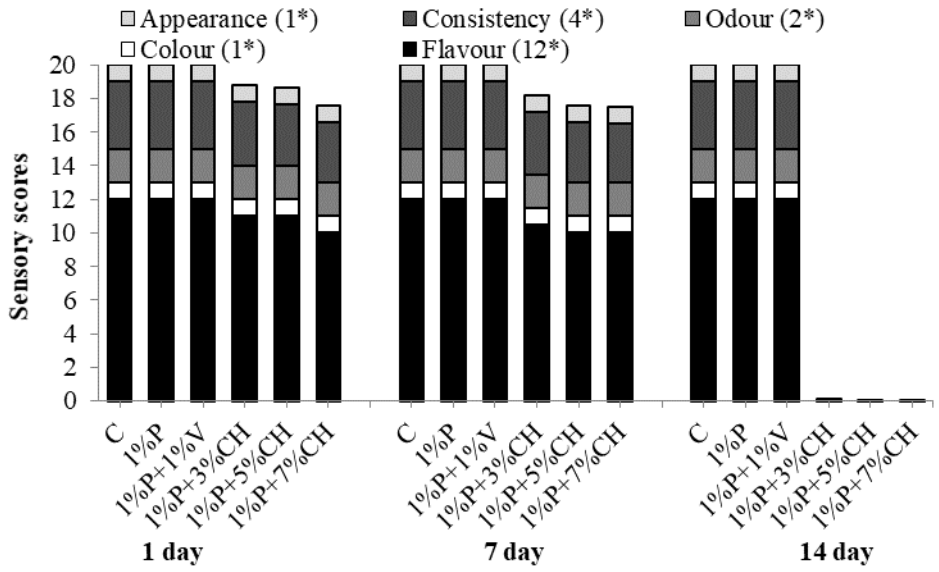

Figure 5. The average number of weighted points achieved in the sensory analysis of oat yogurt samples with different additives
*max. number of points for sensory attributes

The key factor for the development of new food products is the consumer's perception itself. In this research, in order to assess the acceptability of prepared oat yogurt by potential consumers, a verbal hedonic scale with 9 possible answers was conducted on the 1st day of storage. Based on the obtained data (Table 5), the basic statistical parameters (average value, standard deviation, coefficient of variation) and the percentage of desirability and undesirability were calculated.

Table 5. Sensory evaluation of oat yogurt enriched with pumpkin protein concentrate (P), vanilla flavor (V) and different concentrations of blended cherry (CH) after the 1st day of storage

Scores	C	1%P	1%P+ 1%V	1%P+ 3%CH	1%P+ 5%CH	1%P+ 7%CH
9	13	10	14	7	6	8
8	7	11	12	5	7	8
7	4	6	4	6	6	4
6	6	3	1	8	7	5
5	1	1	1	2	2	4
4	1	1	0	4	4	3
3	0	0	0	0	0	0
2	0	0	0	0	0	0
1	0	0	0	0	0	0
Σ	32	32	32	32	32	32
$\overline{X}$	**7,69**	**7,75**	**8,16**	**6,84**	**6,87**	**7,25**
SD	4,4472	4,3906	5,5252	3,1667	3,0867	3,1667
CV	0,5783	0,5665	0,6771	0,4630	0,4493	0,4368
Desirability	96,8 %	96,8 %	100,0 %	87,5 %	87,5 %	90,6 %

$\overline{X}$= average; SD=standard deviation; CV=coefficient of variability

Samples of oat yogurt C with both 1%P and 1%PV (96.8% - 100%) were preferred over samples with cherry in all combinations (87.5% - 90.6%). Looking at the acceptability ratings, the overall rating was satisfactory for samples C with both 1%P and 1%PV considering that it is an unknown new product and that no sugar was added to improve the taste. Samples with 1%PM+3%CH, 1%PM+5%CH and 1%PM+7%CH were not acceptable because their average score was less than 7.5 and was 6.84, 6.87 and 7.25, respectively. The most common comments from the evaluators were that they lacked something in the drinks, and this related to the sweetness of the product and the fullness of the taste. These results are consistent with the results reported by Russo et al. [21] who observed that the presence of juice as a flavoring in oat milk did not improve the tasters' evaluation of the product. On the 14th day of storage, hedonic analysis was not performed due to signs of spoilage of the cherry samples. Based on the average total points achieved during the sensory analysis visible in Figure 4 and Table 5, it can be concluded that fermented beverages C, with 1%P and 1%PV had the highest points. The obtained results of sensory testing suggest that the slightly yellow color and specific taste related to oats that characterized these products, did not negatively affect its sensory perception, even though it is a new product.

Conclusion

The production of fermented oat milk beverages can be a good alternative to fermented dairy products and provide a tasty and nutritious option for consumers looking for dairy-free alternatives. In this study, a new oat-based non-dairy yogurt was developed using a probiotic starter culture and additives (pumpkin protein concentrate and its combination with vanilla extract and cherry blend). Yogurts with formulations C, 1%P and 1%PV showed pH stability and a low degree of syneresis during the entire storage time, which is an advantage for product preservation. Spoilage of yogurt with sour cherry (3, 5 and 7%) appeared on the 14th day of storage after the appearance of mold. From an organoleptic point of view, on the 1st day of storage, the tasters appreciated yogurts with sour cherries the least. Yogurt with 1%PV was the most preferred, but both C and 1%P yogurts showed high desirability, which was also confirmed by the sensory panelists who gave the highest ratings for practically all assessed sensory attributes. Despite the challenges related to the unique characteristics of oat milk, with proper formulation and optimization of production processes, we can hope for products that will have a similar texture and taste to traditional milk yogurt. Further research in this area may lead to wider availability and greater market acceptance of oat milk-based fermented products.

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PRIMJENA KONCENTRATA PROTEINA TIKVE U PROIZVODNJI JOGURTA NA BAZI OVSA

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Sažetak. *Ovas i novi proizvodi na bazi ovsa, kao dio zdrave ishrane, postaju sve popularniji na tržištu funkcionalne hrane. Shodno tome, koristeći zdravstvene prednosti probiotske kulture sa prebiotskim beta-glukanom ovsa, cilj rada je bio da se pokuša razviti receptura za proizvodnju senzorski i reološki prihvatljivog fermentisanog nemliječnog proizvoda na bazi ovsa, uz primjenu koncentrata proteina tikve (P), ekstrakta arome vanilije (V) i blendirane višnje (CH). Suspenzija ovsenih mekinja je fermentisana mešovitom starter kulturom koja je sadržavala Streptococcus thermophilus, Lactobacillus bulgaricus i Bifidobacterium bifidum. Baza ovsa je termički obrađena 10 minuta na 80°C i ohlađena na 37°C za proces inokulacije. Uz kontrolni uzorak (C) koji je bez dodataka, proizvedeni su i uzorci sa kombinacijama: 1%P, 1%P+1%V, 1%P+3%CH, 1%P+5%CH i 1%P+7%CH. Pri praćenju pada pH vrijednosti fermentacija je trajala 6 sati. Tokom 1., 7. i 14. dana skladištenja, svim uzorcima mjerena je aktivna kiselost, viskozitet i sinereza dok je senzorsku procjenu (ukus, konzistenciju, boju, miris i izgled površine) ocijenila panel grupa od 3 člana. 1. dana čuvanja proveden je i test prihvatljivosti i poželjnosti verbalnom hedonističkom skalom od strane 32 ispitanika koji prethodno nisu testirani, a koji su ocjenama od 1 do 9 izrazili opšti utisak o istraživanim proizvodima. Rezultati su pokazali da je fermentacija uzoraka sa dodatkom višnje u svim koncentracijama završena za 5 sati, dok su ostali uzorci fementisali za 7 sati. Takođe, tokom cjelokupnog vremena skladištenja, sinereza je bila statistički značajno viša, a viskozitet niži ($p<0,05$) kod uzoraka sa dodatkom višnje (1%P+3%CH, 1%P+5%CH i 1%P+7%CH) u odnosu na ostale uzorke (C, P i CH). Najbolje senzorske ocjene, svih proizvedenih uzoraka jogurta, bile su nakon 1. dana ocjenjivanja, s tim da je grupa uzoraka sa višnjom dobila nešto niže ocjene zbog lošije ocijenjenih parametara ukusa i konzistencije. 14. dana skladištenja uzorci C, P i CH su zadržali maksimalne ocjene, dok su kod uzoraka sa višnjom uočene pahuljaste nakupine na površini, što je ukazivalo na znake kvarenja i ovi uzorci su eliminisani iz dalje analize.*

Ključne riječi: *jogurt na bazi ovsa, receptura, fermentacija, trajnost*