Original scientific paper
DOI: /10.5513/JCEA01/27.3.5028
Journal of Central European Agriculture, 2026, 27(3), p.799-808

Comparative analysis of oat plant-based milk alternatives and their sensory perception by consumers

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Received: September 26, 2025; accepted: December 19, 2025

ABSTRACT

Fourteen commercially available oat-based milk alternatives from North Macedonia and Serbia were analyzed for composition, physicochemical properties, antioxidant activity, color, and consumer acceptance. The products varied in oat content (6–16%), additional ingredients, and fortification with minerals, vitamins, proteins, and functional fibers. Total phenolic content (TPC) ranged from 6.74±0.09 to 24.25±0.62 mg gallic acid/100 mL, while antioxidant activity (DPPH) varied between 14.22±0.81% and 24.94±0.05%. Color analysis showed lightness (L*) values from 26.99±2.89 to 64.02±7.70, slight red-green shifts (a*), and positive yellow tones (b*), reflecting cereal pigments and processing residues. Stability tests revealed visible particle separation in some samples, notably Sample 1, affecting sensory appearance scores. Consumer evaluation showed that Sample 9 achieved the greatest overall acceptance (3.8), followed by Samples 12 and 13. This preference was associated with more favorable scores for taste and appearance, as well as higher phenolic content. Purchase intention ranged from 10% to 65%, with Sample 9 the most preferred. Sensory quality, particularly taste and aftertaste, strongly influenced purchase decisions. These results highlight the wide variability in composition, sensory characteristics, and consumer preferences of oat-based milk alternatives, underlining the importance of optimizing formulation for both nutritional and sensory quality.

Keywords: oat beverages, dairy milk alternatives, quality

INTRODUCTION

The demand for plant-based beverages as milk alternatives has grown significantly in recent years, driven by the increasing prevalence of lactose intolerance worldwide, allergies to milk proteins, and the perceived health benefits of plant-based drinks. The plant-based market is projected to reach USD 160 billion by 2030, compared to USD 30 billion in 2023 (Bloomberg, 2021). Although dairy milk and plant-based beverages are entirely different food products with unique chemical compositions, many consumers remain confused about their differences. It is important to note that plant-based beverages are referred to as milk "alternatives" only in terms of usage, not nutritional equivalence. Compared to dairy milk, plant-based beverages are generally nutritionally deficient, particularly in protein, lipids, color parameters, minerals, and especially calcium (Silva et al., 2024). On the other hand, plant-based beverages are often considered functional foods due to their content of fibers, phenolic compounds, unsaturated fatty acids, phytosterols, and isoflavones (Zandona et al., 2021; Silva et al., 2024). Soybeans were the first raw material used for milk alternatives, but today oats, almonds, hazelnuts, rice, and other plants are also widely employed. Among these, oat-based beverages are perceived as particularly appealing, offering good taste and texture (Silva et al., 2024). Oat-based

beverages are produced from whole oat groats and are designed to resemble dairy milk. Production processes vary: some include enzyme treatments, while others do not (Deora and Deswal, 2018). One approach involves soaking, grinding, and homogenizing whole oats (Bernat et al., 2015). Another method includes flaking, wet milling, amylase hydrolysis, decanting, formulation, and UHT treatment (Ahlden et al., 1997; Cui et al., 2023). The resulting homogenized water suspension can be consumed directly as a milk alternative or used as a base or additive in products such as gruel, ice cream, milkshakes, yogurt, health beverages, and snacks (Ahlden et al., 1997; Deora and Deswal, 2018).

Nutritionally, oats contain carbohydrates (60–70%), proteins (15–17%), dietary fiber (~12%), fats (~5%), and β-glucan (2–6%) (Rasane et al., 2015). In contrast to most other cereals, the amount of soluble fiber in oats was evenly distributed throughout the entire kernel (Frolich and Nyman, 1988). Also, oat kernel is reach in phytochemicals, polyphenols (e.g., avenanthramides), and exhibit a favorable amino acid balance. Oat intake has been shown to reduce cholesterol and blood glucose levels, primarily due to the presence of β-glucan (a soluble fiber) (Joyce et al., 2019). However, a major drawback of oat milk is its lack of calcium, which is essential for growth and development; therefore, fortification with calcium during processing is necessary (Manasa et al., 2020). Standardization of plant-based milk alternatives is also more challenging compared to cow's milk. Even products made from the same plant can display significant nutritional and sensory variability (Chalupa-Krebzdak et al., 2018). Processing and storage methods strongly influence the nutritional properties of oat-based beverages. For instance, decanting has been shown to cause a 47% increase in vitamin B_6 content but also a 45–74% loss of phosphorus, zinc, calcium, and iron. Similarly, steam-injection UHT treatment can result in a 60% loss of vitamin D_3 and a 30% loss of vitamin B_{12} (Zhang et al., 2007).

Despite the growing market, there is still insufficient literature on the differences among oat-based milk alternatives currently available. Therefore, this research aimed to compare the properties (colour, total phenolic content, and antioxidant activity) of 14 different oat-based milk alternatives which are sold on the market of the Republic of North Macedonia and the Republic of Serbia and to assess consumer perceptions of these products.

MATERIALS AND METHODS

Materials

For the purpose of this study, a total of fourteen samples of commercially available plant-based milk alternatives were collected from local markets. Seven of the samples were purchased in North Macedonia, while the remaining seven were obtained in Serbia. All plant-based samples were oat-based and unflavoured/plain, chosen due to their widespread availability across both markets at the time of sampling. Among the collected plant-based products, only 2 samples were from the same producer and available in both countries. All samples were packaged in 1 L Tetra Pak containers.

Methods

Preparation of hydroalcoholic extracts

The extracts of oat beverages and cow milks were prepared by solvent extraction according to Moretto et al. (2021) with some modifications. 0.5 mL of sample was added to 9.5 mL of 80% ethanol, then mixed for 30 min in an orbital shaker (IKA, MS 3 digital, Germany) at 500 rpm and centrifuged at 5000 g for 30 min (Tehtnica Železniki, LC-320, Slovenia). The separated supernatant was used for further analysis.

Determination of total phenolic content (TPC)

The total phenolic content was determined using the Folin–Ciocalteu reagent (Moretto et al., 2021). Briefly, 1 mL of the diluted Folin–Ciocalteu reagent (1:2 with water) was added to 1 mL of the hydroalcoholic extract, and the mixture was incubated for 3 minutes. Then, 2 mL of 10% Na_2CO_3 was added and centrifuged at 6000 g for 5 min. The absorbance of the supernatant was measured by UV–Vis spectrophotometer (Cary Series 300 spec-

trophotometer, Agilent Technology) at 750 nm. Gallic acid was used as a standard to construct the calibration curve. The results were expressed as milligrams of gallic acid equivalents per 100 mL of product (GAE).

Estimation of antioxidant activity with the DPPH scavenging assay

This method is based on the reaction of the stable free radical 1,1-diphenyl-2-picrylhydrazyl (DPPH) with the antioxidant compounds present in the samples, leading to a decrease in absorbance. 4 mL of 0.1mM DPPH solution was added to 1 mL of hydroalcoholic extract (Moretto et al., 2021). Decrease of absorbance was measured at UV–Vis spectrophotometer (Cary Series 300 spectrophotometer, Agilent Technology) at 517 nm after 30 min, keeping samples in the dark. Percentage of DPPH scavenging inhibition was calculated as:

$$\% \text{ DPPH scavenging} = ((A_{control} - A_{sample}) \times 100) / A_{control}$$

Colour

The colour of the oat-based samples was evaluated using a Konica Minolta Chroma Meter CR-400 (Osaka, Japan), which measures colour parameters in the L* (lightness), a* (red-green), and b* (yellow-blue) space.

Extent of separation

Oat based milk alternatives were stored at 4 °C for 24 h, and the next day was recorded the visible separation of the samples.

Sensory evaluations

Sensory evaluation was conducted (n = 20 panellists) to assess the sensory quality of the products. Attributes evaluated included appearance, odor, taste, aftertaste, and overall acceptability using a structured 5-point hedonic scale. Additionally, participants were asked whether they would consider purchasing the product after tasting it. Prior to conducting the sensory evaluation and survey, ethical approval was obtained from the Ethics Committee at the Faculty of Agriculture in Čačak (Document number 1346/1 from 02/07/2025).

Statistical analysis

Microsoft Office Excel was used for determination of standard deviation of every sample. The presented values are the average of three repetitions. Pearson's linear correlation analysis was performed between the quantity of total phenolic content and antioxidant activity of the sample.

RESULTS AND DISCUSSION

A total of fourteen commercial oat-based milk alternatives originating from North Macedonia and Serbia were analysed (Table 1). Although oats and water formed the base of all products, the formulations varied considerably in terms of additional ingredients, oat content, and functional enrichment. The proportion of oats ranged between 6% and 16%, with most products containing between 10–14% oats. In several cases, oats were incorporated either in the form of whole grains, oat syrup or fermented oats, reflecting different processing approaches. Sunflower oil was the most frequently added fat source, often declared as being of organic origin, while some products used rapeseed oil or a combination of oils. The addition of pea protein powder was noted in certain formulations, aiming to enhance the protein content. Mineral fortification was widespread, most commonly through calcium carbonate or tricalcium phosphate, with the declared purpose of improving the nutritional equivalence of plant-based beverages to cow's milk. Some products included additional functional components such as inulin (a prebiotic fiber), soluble corn fibers, and algal-derived calcium (*Lithothamnium calcareum*). A range of stabilizers, particularly gellan gum, and acidity regulators such as calcium phosphate or dipotassium phosphate were also present. Vitamin fortification varied among the products. Most frequently added were vitamins B_2, B_{12}, and D_2. Flavoring agents were generally minimal, with only a few products declaring natural flavors. Salt or sea salt was almost universally added, either in coarse or refined form. Shelf-life after opening ranged from 2 to 5 days, depending on formulation and processing, with most products declared stable for 3–4 days under refrigeration.

Table 1. Composition of oat plant-based milk alternatives

Sample	Country of origin	Components			Other components
		Characteristics	Proportion (%)	Shelf life after opening	
S1	Spain	water, oats	14	3-4	calcium carbonate, stabilizers (gellan gum), vitamin D
S2	Italy	water, oats	16	3-4	sunflower oil, alga *Lithothamnium calcareum*, salt
S3	EU	water, oats	14	3	sunflower oil (organic agriculture), salt
S4	Germany	water, oats from whole grains	11	3-4	sunflower oil (organic agriculture), sea salt
S5	EU	water, oats	10.5	5	soluble corn fibers, sunflower oil, tricalcium phosphate, sea salt, stabilizers (gellan gum), vitamin B_2, B_{12}, D_2
S6	Italy	water, oats	12	4	sunflower oil, sea salt
S7	Serbia	water, oat syrup	11.7	3	refined sunflower oil, calcium (tricalcium phosphate), vitamins B_2, D_2, B_{12}, stabilizer (gellan gum), sea salt
S8	EU	water, fermented oats	8.7	4-5	rapeseed oil, inulin, calcium (calcium carbonate), pea protein powder, sea salt, natural flavor, stabilizer – gellan gum, acidity regulator – calcium phosphate, vitamin B_{12}, vitamin D
S9	Italy	water, oats	16	3-4	sunflower oil, coarse sea salt
S10	Italy	water, oats	14	3-4	salt
S11	Serbia	water, oat syrup	11.7	3	refined sunflower oil, calcium (tricalcium phosphate), vitamins B_2, D_2, B_{12}, stabilizer (gellan gum), sea salt
S12	EU	water, oats	14	3	sunflower oil (organic agriculture), salt
S13	Italy	water, oats	10	2-3	sunflower oil, salt
S14	EU	water, oats	6	4	sunflower oil, pea protein, calcium carbonate, acidity regulator, dipotassium phosphate, sodium hydrogen carbonate, salt, stabiliser, gellan gum, natural flavourings, vitamin D, vitamin B_{12}

Table 2 compares the nutritional composition of 14 plant-based oat samples (S1–S14). Overall, the products are relatively low in energy, ranging between about 132–234 kJ (32–58 kcal) per serving. Fat content is generally low (0.6–1.8 g), except for S14, which stands out with 3.5 g of fat, including higher saturated fat. Carbohydrates vary more widely: most samples contain 6–10 g of saccharides, with sugars making up the majority. A few samples (like S7, S8, and S11) are lower in sugars, while S2 and S10 are among the sweetest. Fibre is inconsistently present, with some products containing small amounts (up to 1.4 g), while others have none. Protein levels remain modest, between 0.3 and 1.3 g. Salt content is mostly low, though S14 again stands out with a much higher level (0.6 g). Regarding micronutrients, several samples are fortified with vitamin D (0.75 µg), and some also provide vitamin B_{12} (0.375–0.38 µg), riboflavin (0.21 mg), and calcium (120 mg).

Table 2. Nutritional parameters of oat plant-based milk

Parameters	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14
Energy (kJ/ kcal)	188/45	234/58	208/50	168/40	192/46	211/50	132/32	159/38	215/51	202/48	132/32	208/50	154/37	191/46
Fat (g)	0.80	1.60	1.30	1.40	1.50	1.80	1.10	1.80	1.00	0.60	1.10	1.30	1.20	3.50
of which saturated (g)	0.20	0.20	0.20	0.20	0.20	0.9	0.16	0.20	0.20	0.13	0.16	0.20	0.10	0.50
Saccharide (g)	7.70	10.20	7.70	6.00	6.60	7.90	4.40	4.10	9.00	10.00	4.40	7.70	5.60	2.50
of which sugar (g)	5.00	6.20	3.10	5.20	3.30	3.80	3.60	1.20	4.20	3.22	3.60	3.10	4.40	0.60
Fibre (g)	0.70	0.00		0.50	1.40	0.60		1.10						0.70
Protein (g)	1.30	0.50	1.20	0.60	0.80	0.30	0.50	0.80	1.00	0.80	0.50	1.20	0.40	0.80
Salt (g)	0.04	0.20	0.08	0.13	0.08	0.04	0.11	0.13	0.09	0.03	0.11	0.08	0.10	0.60
D (µg)	0.75				0.75		0.75	0.75			0.75			0.75
B_{12} (µg)							0.375	0.38			0.375			0.38
B_2 (mg)					0.21		0.21				0.21			
Calcium (mg)	120	120					120	120			120			120

Similar results were presented by Fructuoso et al. (2021), who compared plant-based beverages from 13 countries, comparing nutritional values obtained from product labels, databases, and beverages prepared specifically for the study. In total, 122 beverages were evaluated. For oat-based beverages, the reported energy content ranged from 33 to 55 kcal/100 mL. Carbohydrate levels varied between 1.0 and 8.9 g/100 mL, protein content ranged from 0.4 to 1.86 g/100 mL, and lipid content ranged from 0.37 to 2.69 g/100 mL. In addition, the dietary fiber content of oat-based beverages was found to range from 0.8 to 4.4 g/100 mL, while the calcium content averaged around 120 mg/100 mL (Fructuoso et al., 2021). In plant-based milk alternatives, the most important components are calcium and dietary fibre (McClements, 2020). High levels of added soluble calcium ions (Ca^{2+}) decrease the bioaccessibility of certain hydrophobic bioactives by promoting the precipitation of anionic bioactive-loaded mixed micelles (Tan et al, 2020). Dietary fibers can have a positive digestive effect, but also can have a negative effect on bioacecessibility of lipid components (McClements, 2018). The oil phase in emulsion-based delivery systems can affect the bioavailability of encapsulated hydrophobic bioactives, including oil-soluble vitamins and nutraceuticals (McClements, 2018). McClements (2020) noted that it is important to optimize the level of added oil and that around 2%–6% oil is sufficient to ensure good bioaccessibility of highly hydrophobic bioactives (like carotenoids and oil-soluble vitamins).

TPC and antioxidant activity

Figure 1 presents total phenolic content (TPC) and antioxidant activity (DPPH) of the analyzed oat-based beverages. The TPC varied considerably across samples, from as low as 6.74±0.09 mg gallic acid/100 mL (S12) to as high as 24.25±0.62 mg/100 mL (S1). This variability is consistent with previous findings showing that phenolic content in oat-based beverages depends strongly on raw material quality, processing methods, and fortification practices (Viebke, 2014). Antioxidant activity (DPPH radical scavenging capacity) ranged from 14.22±0.81% (S14) to 24.94±0.05% (S3). Interestingly, high TPC did not always correlate directly with higher DPPH activity—for example, S5 contained relatively high phenolics (23.28±0.39 mg/100 mL) but had modest antioxidant activity (15.65±0.01%). Such discrepancies have been noted previously, since different phenolic compounds contribute differently to radical scavenging capacity depending on their structure and reactivity (Varga et al., 2018).

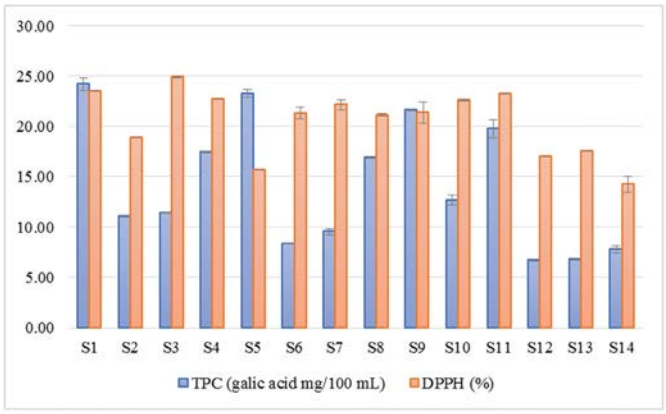


Figure 1. Total phenolic content (TPC) and antioxidative activity in oat based milk alternatives

Oats are a valuable source of bioactive compounds, particularly phenolic acids and flavonoids (Moretto et al., 2021), especially rich in avenanthramides, a unique class of polyphenols with well-documented antioxidant, anti-inflammatory, and anti-atherogenic properties (Gangopadhyay et al., 2015). In addition to phenolic acids, flavonoids, and avenanthramides, the antioxidant activity of oats has been associated with other components, including β-glucans, bioactive peptides, tocopherols, and phytic acid, which may act synergistically to enhance the overall antioxidant potential of oat-based products (Peterson, 2001; Du et al., 2014; Lazaridou and Biliaderis, 2007). These compounds contribute significantly to the radical scavenging capacity of oat-based beverages, potentially supporting health benefits beyond basic nutrition. A positive but weak correlation was observed between total phenolic content and antioxidant activity ($r = 0.31$), indicating that phenolic compounds contribute to radical scavenging capacity, although they are not the sole determinants of antioxidant activity.

Colour

Colour in plant-based milk products is largely influenced by the pigments naturally present in the raw materials as well as processing conditions (Petrevska et al., 2024). In the present study, the lightness parameter (L*) for commercial oat-based milk samples ranged from 26.99±2.89 (S10) to 64.02±7.70 (S4) (Table 3), and typically, oat beverages have a creamier or beige tone due to cereal pigments and processing residues. The a* values, representing the red-green axis, were generally close to zero for all samples, with most oat-based products showing slightly negative values, indicating a small shift towards the green spectrum. Exceptions were Samples 1, 7, 8, 11, and 16, which had slightly positive a* values, indicating a minor reddish tint. The b* values, which represent the yellow-blue axis, were positive across all samples, confirming a shift towards yellow tones, which is typical for oat-based beverages due to the presence of carotenoids and Maillard reaction products formed during thermal processing (Martins et al., 2000).

Table 3. Color parameters of the oat plant-based milk alternatives

Samples	L*	a*	b*
1	47.26 ± 0.48	1.05 ± 0.02	9.36 ± 0.05
2	48.69 ± 3.50	-1.03 ± 0.27	6.09 ± 0.16
3	59.24 ± 6.11	-0.57 ± 0.23	6.44 ± 0.45
4	64.02 ± 7.70	0.22 ± 0.32	10.51 ± 0.99
5	61.22 ± 7.77	-0.94 ± 0.32	12.43 ± 1.27
6	55.87 ± 3.04	-0.17 ± 0.12	8.43 ± 0.25
7	40.46 ± 3.96	1.23 ± 0.17	12.30 ± 0.86
8	61.28 ± 7.80	0.37 ± 0.10	9.20 ± 0.99
9	47.29 ± 8.28	-0.62 ± 0.40	6.26 ± 0.56
10	26.99 ± 2.89	-0.80 ± 0.22	3.81 ± 0.23
11	48.87 ± 3.67	0.06 ± 0.19	13.20 ± 0.74
12	51.27 ± 3.71	-0.22 ± 0.16	7.06 ± 0.32
13	51.32 ± 4.78	-1.71 ± 0.31	3.86 ± 0.10
14	53.52 ± 2.47	0.72 ± 0.04	7.57 ± 0.25

Among the oat-based samples, S11 recorded the highest b* value (13.20±0.74), suggesting the strongest yellow intensity, whereas S13 had the lowest (3.86±0.10), giving it a more muted, whitish appearance. The differences in color among plant-based milk alternatives are due to variations in their compositions and structures, which come from the different ingredients and processes used to make them (McClements, 2020). The addition of oil to these products enhanced their lightness, likely because it created small lipid droplets coated with protein that scattered light. A high-pressure homogenize could be used to increase the lightness of plant-based milk alternatives, because it reduces the particle size.

Extent of separation

Figure 2 illustrates the visible separation observed after 24 h in S1, S10, and S13. The differences among the samples were evident not only in color but also in appearance, which reflected the stability of the dispersed particles. Sample 1 showed the lowest stability, with large particle separation, which contributed to its low sensory score for appearance (Figure 2).



Figure 2. Extent of separation among samples of oat-based milk alternatives

This instability can be attributed to the type of stabilizers used in the formulation (Table 1). The stability of plant-based milk alternatives depends on several factors, including the size of dispersed particles (fat globules, solid particles, and proteins), which can impart sandy, gritty, or chalky textures and lead to sediment formation at the

bottom of the package during storage. Other contributing factors include the efficiency of emulsion formation, the presence of undisintegrated starch granules, and the solubility of proteins (Paul et al., 2019; Reyes-Jurado et al., 2021), as well as particle size and polydispersity index (PDI) (McCarron et al., 2024). In addition, processing conditions—such as mill type, extraction temperature, homogenization, and thermal treatments applied for preservation—strongly influence both suspension stability and the microbiological quality of the final product (Reyes-Jurado et al., 2021). Zhou et al (2023) noted positive correlations between the cultivar's protein and plant cell debris content and the separation rate of the final products, as well as between the cultivar's lipid content and the creaming of the final products.

Sensory evaluation

Sensory evaluation plays a key role in determining whether consumers will actually like and accept a product. According to the results presented in Figure 3, the highest overall acceptance was recorded for S9 (3.8), followed closely by S12 (3.7) and S13 (3.65). These products also scored well in taste and appearance, indicating a positive balance of visual appeal and flavour. The total phenolic content (TPC) of Sample 9 was 21.61 mg gallic acid/100 mL (Figure 1). Phenolic compounds in oats, particularly avenanthramides, may also influence sensory properties, as they have been shown to correlate with bitter and astringent perceptions in consumers (Günther-Jordanland et al., 2016). S3 also performed relatively well (overall acceptance 3.55), reflecting a favourable consumer perception. In contrast, several oat-based samples scored below 3.0 for overall acceptance, including S6 (2.9), S7 (2.6), S10 (2.45), and S11 (2.85). The lowest scores were seen in S10 across nearly all attributes, suggesting potential formulation- or storage-related quality issues. Negative deviations in taste and aftertaste appear to be the main drivers of low acceptability in these cases. However, sensory acceptance of oat-based beverages is determined by multiple factors, including basic chemical composition. Sugars contribute to sweetness and can partially mask bitterness, while fat content affects mouthfeel, creaminess, and flavor perception and may attenuate astringency through interactions with phenolic compounds. Therefore, the observed sensory differences among samples likely reflect the combined effects of phenolic content and macronutrient composition rather than a single component acting in isolation (Zhou et al., 2023; Petrevska et al., 2024). Across all oat-based samples, appearance scores ranged widely from 2.15 (S10) to 3.8 (S12), showing that visual presentation is a differentiating factor for consumer perception. Odor ratings tended to be more uniform, with most products falling between 3.0 and 3.5, except for the lower ratings of S4 and S10. Taste and aftertaste scores showed a stronger link to overall acceptance, indicating that flavour quality is a key determinant of consumer preference. Improving flavour balance and aftertaste characteristics could enhance the overall appeal of lower-scoring oat-based products.

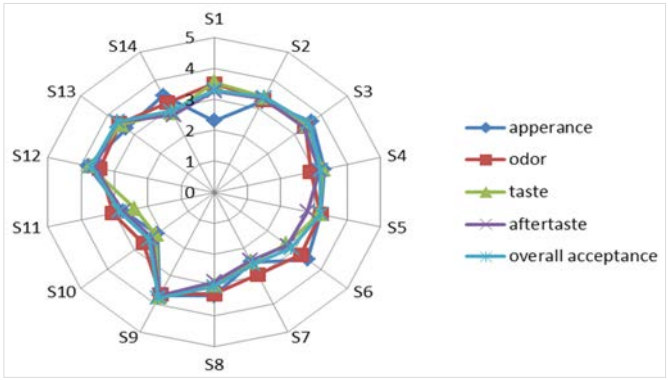


Figure 3. Sensory evaluation of plant - based oat milk

This study also examined consumer preferences for 14 commercially available oat-based milk alternatives (Figure 3). The purchase intention results revealed a considerable variation among the evaluated oat-based milk samples, with percentages ranging from 10% (S10) to 65% (S9). Among the oat-based milk samples, the highest purchase intention was observed for S9 (65%), followed by S1 (55%), S2 (50%), and S13 (50%). These samples also scored higher in sensory evaluation for attributes such as smooth texture, balanced flavor, and pleasant aftertaste, suggesting that positive sensory perception directly influenced consumer willingness to purchase. On the other

hand, samples with lower purchase intention, such as S10 (10%) and S7 (15%), were associated with less favorable sensory ratings, often due to off-flavors, excessive cereal taste, or grainy texture. Interestingly, some oat-based milk samples with moderate sensory scores (e.g., S4, S8, and S14) still achieved purchase intentions between 30% and 35%, indicating that while sensory quality is a primary driver, other factors such as perceived health benefits, familiarity with the product, or brand loyalty may also influence consumer purchase decisions. Although it is generally known that the appearance of a certain product plays an important role in the decision of customers to buy a product, the low rating of the appearance of S1 (Figure 2) did not affect the overall sensory rating; what is more, it was the third most popular product for consumers to buy (Figure 4).



Figure 4. Consumer purchase decisions for oat-based milk alternatives

Silva et al (2024) analyzed consumer motivations for trying and purchasing oat milk to better understanding desirable attributes for oat milks. They noted that when shopping for oat milk, consumers are most influenced by the price, followed by the flavor, type, label claims, and brand.

CONCLUSION

This study demonstrates that commercially available oat-based milk alternatives differ substantially in composition, stability, phenolic content, antioxidant activity, color, and sensory properties. Consumer preferences were strongly influenced by taste, aftertaste, and texture, while appearance played a secondary role. Products with higher overall acceptance and purchase intention combined favorable sensory attributes with functional benefits, such as phenolic content. Formulation factors—including oat content, type of stabilizers, and added oils—affect both product stability and visual quality. Optimizing these factors can enhance consumer satisfaction and marketability. These findings provide valuable insights for producers seeking to improve oat-based beverages, balancing nutritional, functional, and sensory qualities to meet consumer expectations.

ACKNOWLEDGMENTS

This article/publication is based upon work from COST Action FoodWaStop, CA22134, supported by COST (European Cooperation in Science and Technology).

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