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PHYSICO-CHEMICAL PARAMETERS AND SENSORY EVALUATION OF FRESH AND DRIED "KOSSARA" CHERRY FRUITS

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Abstract: *Extending the availability of seasonal fruits is very important for consumers. The paper reveals several physico-chemical parameters and sensory attributes of fresh and dried (conventional and freeze-dried) "Kossara" cherry fruits. The "Kossara" cherry cultivar is an early-ripening native Bulgarian variety with large fruits and a pleasant sweet-sour taste. Moisture content, water activity, titratable acidity, pH, total soluble solids, CIE-lab colour parameters were evaluated. The sensory evaluation revealed the fruits' overall appearance, colour, consistency, taste, and aroma. The water activity of the conventionally dried cherry was more similar to the fresh one than to the freeze dried one. Significant differences in other studied parameters existed between the fresh and dried fruits. The paper provides pilot information about native Bulgarian cherries. This is a stepping-stone for future comparison and further research on the subject.*

Keywords: *Storage, Seasonal fruits, Prunus avium L., Change.*

INTRODUCTION

Seasonal fruits are available for a short period of time according to their ripening periods. Sweet cherries are seasonal non-climacteric fruits, with a distinct aroma, deep rose-red color, and sweet-sour taste (Chezanoglou et al., 2024). Their chemical consumption has several health beneficial properties *i.e.* prevention and management of non-communicable diseases due to the presence of compounds with antioxidant potential, vitamins, minerals, among others (Faienza et al., 2020). Cherries have high moisture level which is typically attributed to fruits (Zhu et al., 2017). They contain natural pigments (carotenoids, flavonoids, and anthocyanins) that can be successfully used in culinary practice (Mihaylova et al., 2024). The color of food is some of the first attributes that play a role in food choice. This is especially true for fruits where color is a good predictor of ripening and taste (Ma et al., 2022). Drying is a classic technology for food preservation (Adeyeye et al., 2022). During this process some quality changes occur like color alteration, pH value variation, moisture decrease, changes in the free water in the product (Calín-Sánchez et al., 2020). Consequently, the aim of this research is to evaluate color, moisture content, total soluble solids, titratable acidity, pH, water activity, and sensory attributes in fresh, conventionally, and freeze-dried Bulgarian cherry fruit from the "Kossara" variety providing pilot information about native Bulgarian cultivars as well as giving reference for future comparison and further research on the subject.

EXPOSITION

Cherry fruits from the "Kossara" variety were harvested at full ripeness from the experimental fields of the Fruit Growing Institute, Plovdiv, Bulgaria in 2024, and transported in an air-conditioned vehicle to the University of food technologies for processing. The fruits were washed and separated in three parts. One was analysed fresh. The second one was de-stoned and fruits were placed on flat trays with holes in a fruit dryer (Sencor SFD 6600BK, Japan). The slices were dried at 35ºC for 60 h., then placed in labelled plastic containers with seals until subsequent analysis. The third part was de-stoned and sliced with a ceramic knife. The slices were then frozen in a freezer for 24h. and freeze-

dried in a vacuum freeze dryer (BK-FD12S, Biobase, Shandong, China) at 3,5 MPa and −55 °C. The dried slices were then placed in labelled plastic containers with seals where they were stored for further analysis.

Evaluation of moisture content, water activity, and total soluble solids.

The moisture content (%) of studied samples was established using an infrared moisture analyser PMB 53 (Adam Equipment Inc., Oxford, UK). Total soluble solids (TSS, %) were calculated using a digital handheld refractometer (Opti Brix 54, Bellingham + Stanley, Kent, UK). The water activity was measured using a LabSwift-aw, Novasina AG, Lachen, Bassersdorf, Switzerland. The titratable acidity (TA) was measured by titration with 0.1n NaOH. Results are expressed as citric acid equivalents. The pH was determined using a Jenway 550 Benchtop handheld pH meter (Cambridgeshire, UK) with the electrode standardized to pH 4.0; 7.0 and 10.00 buffers (Sigma-Aldrich, Darmstadt, Germany).

Fresh, conventionally and freeze-dried cherries from the "Kossara" variety were evaluated for their moisture content, water activity, pH, titratable acidity and TSS (Table 1). Conventionally dried cherries had lower moisture content compared to freeze-dried ones. However, freeze-dried fruits had the lowest water activity. These results are comparable to the ones established by Can Karaca et al. (2020) for freeze-dried sour cherry powders. Total soluble solids were the highest in the fresh cherry fruit, followed by the conventionally dried. The established data about fresh fruits is relatable to the research of Stefanova & Minkov (2022) where the TSS varied from 14.63 to 16.83. The pH values was the highest in conventionally dried fruit, while titratable acidity was the highest in the freeze-dried samples. Sirbu et al. (2012) report similar TA values for fresh sweet cherries cultivars native to Romania. The data about conventionally dried cherries can be considered new since there is no information on the subject in the available literature.

Table 1. Moisture content, water activity, pH, TA, TSS of "Kossara" cherry fruit

Parameter/sample	Moisture content, %	Water activity	pH	TA	TSS, ºBrix
Fresh fruit	64.65±1.07^{a}	0.982±0.01^{a}	3.8	0.07±0.01^{b}	14.95±0.07^{b}
Conventionally dried fruit	3.49±1.22^{b}	0.789±0.01^{b}	6.61	0.06±0.01^{b}	5.65±0.21^{c}
Freeze-dried fruit	5.10±0.33^{b}	0.221±0.02^{c}	4.86	0.11±0.00^{a}	3.15±0.49^{a}

Different letters in the same column indicate statistically significant differences ($p < 0.05$), according to ANOVA and the Tukey test.

Evaluation of CIE-lab colour parameters of cherry fruit

A PCE-CSM 2 (PCE-CSM instruments, Meschede, Deutschland) with a measuring aperture of 8 mm was applied to examine the colour parameters (L*, a*, b*, c, h) of each fruit sample.

The lightness value for the fresh fruit sample was 28.63±2.20. This value is smaller than the available in literature about four sweet cherry cultivars where lightness varied from 32.3 ± 3.1 to 37.2 ± 4.1 (Rodrigues et al., 2020). The conventionally and freeze-dried samples has similar values to each other. These results showed more similarity to lightness values reported for sour cherry skin values (Desiderio et al., 2023). The freeze-dried cherries appeared redder compared to the conventionally dried and very similar to the fresh ones. The same trend applied for the "b" component. Chroma is associated with the vividness/dullness of colour. The chroma values indicate less vividness indicating pastel colours in the conventionally dried samples compared to fresh and freeze-dried ones. The hue angle varied from 11.40±7.30 to 17.55±3.23.

Table 2. CIE-lab colour parameters of "Kossara" cherry fruit

Parameter/sample	L*	a*	b*	c	h

Fresh fruit	28.63±2.20[a]	16.77±2.42[a]	5.41±1.96[ab]	17.65±2.93[a]	17.55±3.23[a]
Conventionally dried	23.21±2.32[a]	3.85±1.60[b]	0.82±0.65[b]	4.56±1.47[b]	11.40±7.30[a]
Freeze-dried	22.40±5.44[a]	19.78±6.15[a]	5.81±2.42[a]	20.64±6.58[a]	15.85±2.57[a]

Different letters in the same column indicate statistically significant differences ($p < 0.05$), according to ANOVA and the Tukey test.

Sensory evaluation of cherry fruits

The sensory evaluation followed ISO 8586:2023 and ISO 8587:2006/Amd. 1:2013. The performed sensory evaluation covered overall appearance (n= 2), aroma (n= 4), colour (n= 3), taste (n= 4), consistency (n= 5). A 9-point scale was used in the evaluation.

The sensory evaluation gives important information about the overall acceptance of a specific product for the consumer. Fresh fruits are generally values for their organoleptic properties *i.e.* firmness, shape, color, among others (Delgado et al., 2013). Ivanova et al. (2023) also indicate appearance, color, taste, and consistency as important in the sensory evaluation of cherry fruit. The same authors reveal that variety-dependent differences existed. The sweet-sour taste of cherries forms their uniqueness and total soluble solids and titratable acidity indicate this parameter (Ivanova et al., 2023). Some negative qualities as cracks, bird damage, abnormal smell and taste are also very important in the fruit evaluation (Silva et al., 2021).

The performed sensory analysis showed differences between the three studied fruits (Table 3). The conventionally and freeze-dried fruit were different not only in color, but also consistency, and aroma. Freeze-drying is considered one of the best food preservation processes but also one of the expensive and energy consuming ones, requiring costly equipment (Yao et al., 2023). On the other hand, conventional drying is more accessible and affordable to the general consumer. None of the dried samples were similar enough to the fresh fruit. However, drying along with canning is a way of providing seasonal fruits year-round.

Table 3. Sensory evaluation of "Kossara" cherry samples

Attribute/sample	Fresh	Conventionally dried	Freeze-dried
Appearance			
Fresh	9.0±0.0[a]	7.2±0.3[c]	8.5±0.1[b]
Rotten	0.0±0.0[b]	2.0±0.5[a]	0.3±0.1[b]
Colour			
Red	9.0±0.0[a]	3.4±0.8[c]	4.3±0.7[b]
Pink	1.0±0.2[b]	0.0±0.0[c]	6.2±1.0[a]
Dark red	1.0±0.3[c]	8.5±0.3[a]	2.2±0.6[b]
Aroma			
Cherry-like	9.0±0.0[a]	4.9±1.0[c]	7.8±0.3[b]
Chemical	0.0±0.0[b]	1.0±0.2[a]	0.0±0.0[b]
Earthy	0.0±0.0	0.0±0.0	0.0±0.0
Sweet	6.7±0.8[a]	0.0±0.0[c]	6.0±0.4[b]
Taste			
Sweet	5.7±0.6[b]	4.5±0.2[c]	6.2±0.3[a]
Sour	3.1±1.0[b]	4.5±0.5[a]	3.0±0.3[b]
Bitter	0.0±0.0	0.0±0.0	0.0±0.0
Tasteless	0.0±0.0[b]	2.0±0.2[a]	0.0±0.0[b]
Consistency			
Crunchy	7.2±0.7[b]	0.0±0.0[c]	8.0±0.1[a]
Soft	3.3±0.5[b]	3.1±0.3[a]	3.9±0.4[b]
Gum-like	0.0±0.0[b]	4.5±0.4[a]	0.0±0.0[b]
Hard	2.4±0.3[b]	2.0±0.3[c]	3.6±0.2[a]
Sticky	0.0±0.0[c]	8.1±0.2[a]	2.4±0.1[b]

Different letters in the same row indicate statistically significant differences ($p < 0.05$), according to ANOVA and the Tukey test.

CONCLUSION

This paper presented a comparison between fresh cherry fruits and two variations of its drying (conventional and freeze-drying). It reveals pilot information about native Bulgarian cherries. The CIE-lab colour spectra analysis revealed that freeze-dried cherries were redder than fresh and conventionally dried. Conventionally dried cherries had lower moisture content compared to freeze-dried ones. Freeze-dried ones had the lowest water activity. The sensory evaluation revealed differences between the fruits' overall appearance, colour, consistency, taste, and aroma. The results are a stepping-stone for future comparison and further research on the subject.

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