



EUROPEAN
GREEN
CONFERENCE

3D-PRINTED FUNCTIONAL FOODS FROM CORNELIAN CHERRY: IMPACT OF CULTIVARS AND HYDROCOLLOIDS ON BIOACTIVE PROPERTIES

Lucija KATUŠIN ¹, Anica BEBEK MARKOVINOVIĆ ¹, Tomislav BOSILJKOV ¹, Boris DURALIJA ², Sandra ZAVADLAV ³, Danijela BURSAĆ KOVAČEVIĆ ^{1*}

¹ University of Zagreb Faculty of Food Technology and Biotechnology, Pierottijeva 6, 10000 Zagreb, Croatia

² Faculty of Agriculture, University of Zagreb, Svetošimunska Cesta, Croatia

³ Department of Food Technology, Karlovac University of Applied Sciences, Trg J. J. Strossmayera 9, 47000 Karlovac, Croatia

E-mail: danijela.bursac.kovacevic@pbf.unizg.hr

INTRODUCTION

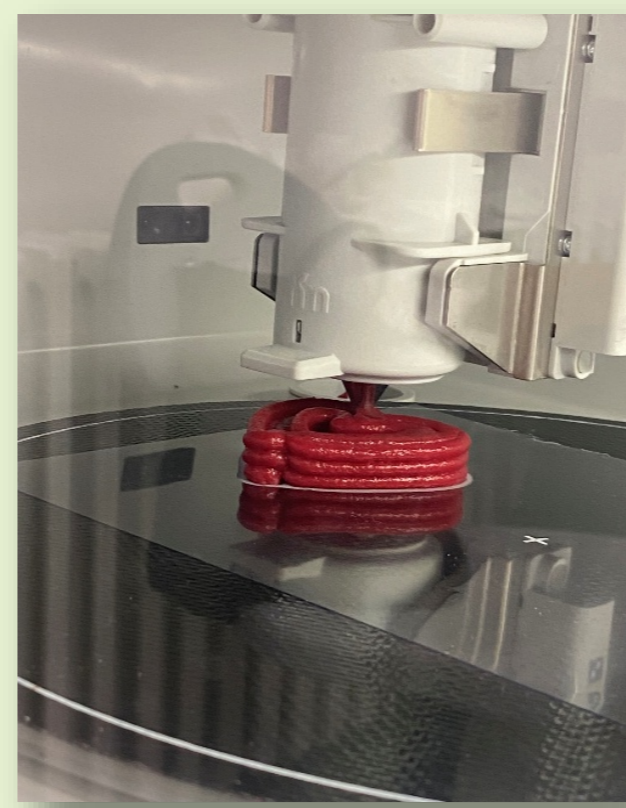
Cornelian cherry (*Cornus mas* L.) is a traditional fruit species that remains insufficiently explored despite its rich nutritional composition and strong bioactive potential. The fruit is a valuable source of bioactive compounds, vitamins, and organic acids associated with health-promoting properties, making it a promising ingredient for the development of innovative functional foods. In this context, the development of functional foods based on cornelian cherry should also consider three-dimensional printing (3DP) as an innovative and sustainable food production technology. Food 3D printing enables the creation of customized products with enhanced nutritional and sensory properties, while also contributing to sustainability through improved ingredient utilization, reduced food waste, and more efficient production processes.

MATERIALS AND METHODS

Three cornelian cherry cultivars: Schönbrunner Gourmet Dirndl, Kasenlaker, and Panchevar were combined with different hydrocolloids (wheat starch, guar gum, Arabic gum) to produce 3D-printed snacks.

Spectrophotometric determination of bioactive compounds: total phenolic content (TPC), hydroxycinnamic acids (HCA), flavonols (FL), total flavonoids (TF).

Determination of antioxidant activity - FRAP and ABTS assays



OBJECTIVE OF THE STUDY

This study investigates the potential of cornelian cherry as a raw material for the development of functional foods using 3DP. Three cultivars to produce 3D-printed snacks.

RESULTS AND DISCUSSION

Kasenlaker samples showed intermediate values of bioactive compounds and antioxidant capacity, while Schönbrunner Gourmet Dirndl generally exhibited the lowest values, particularly for CT and ANT content. The addition of hydrocolloids influenced the retention and stability of phenolic compounds differently depending on the hydrocolloid type and cultivar. In most samples, the incorporation of wheat starch resulted in a decrease in TPC, CT, ANT, FRAP, and ABTS values compared to the corresponding control samples. This reduction may be associated with interactions between starch polymers and phenolic compounds, potentially limiting extractability and antioxidant availability. Guar gum also caused a decrease in most investigated parameters; however, its effect was less pronounced in certain samples.

Interestingly, guar gum preserved ABTS antioxidant activity in the Panchevar formulation, where the value (2.63 mmol Trolox/100 g) remained similar to the control sample. This may indicate a protective effect of guar gum on specific antioxidant compounds during formulation. Among the tested hydrocolloids, Arabic gum generally showed the most favorable effect on the preservation of bioactive compounds and antioxidant activity. Samples containing Arabic gum retained relatively high TPC, CT, ANT, and antioxidant values compared to other hydrocolloid formulations. In Schönbrunner Gourmet Dirndl, Arabic gum even increased ABTS antioxidant activity compared to the control sample. The positive effect of Arabic gum may be related to its good emulsifying and encapsulating properties, which can protect phenolic compounds from degradation and improve their stability.

Sample	Cultivar	Hydrocolloids	TPC	CT	ANT	FRAP	ABTS
1	Schönbrunner Gourmet Dirndl	/	298,43 ± 4,08	133,15 ± 2,53	30,65 ± 0,11	2,30 ± 0,02	1,57 ± 0,00
2		Wheat starch	309,01 ± 9,51	115,75 ± 0,67	28,86 ± 0,54	2,05 ± 0,18	1,61 ± 0,05
3		Guar gum	252,79 ± 8,60	103,00 ± 4,53	27,90 ± 0,40	1,97 ± 0,10	1,71 ± 0,00
4	Kasenlaker	Arabic gum	301,60 ± 1,36	125,40 ± 5,73	30,08 ± 1,38	2,18 ± 0,15	2,20 ± 0,06
5		/	312,06 ± 11,78	163,81 ± 0,39	46,15 ± 1,96	2,29 ± 0,06	2,24 ± 0,01
6		Wheat starch	280,99 ± 16,76	126,76 ± 0,27	36,47 ± 0,26	1,70 ± 0,03	1,43 ± 0,12
7	Panchevar	Guar gum	273,52 ± 9,52	170,73 ± 0,13	43,21 ± 0,83	2,10 ± 0,07	1,67 ± 0,03
8		Arabic gum	272,82 ± 17,67	155,51 ± 3,20	41,24 ± 0,54	2,06 ± 0,00	1,93 ± 0,14
9		/	385,39 ± 4,98	250,34 ± 0,13	55,82 ± 1,01	3,35 ± 0,20	2,61 ± 0,05
10	Schönbrunner Gourmet Dirndl	Wheat starch	322,91 ± 4,57	165,78 ± 0,27	42,27 ± 0,37	2,59 ± 0,12	1,94 ± 0,01
11		Guar gum	327,60 ± 5,44	184,65 ± 1,47	44,06 ± 0,20	2,38 ± 0,03	2,63 ± 0,06
12		Arabic gum	349,34 ± 11,78	191,32 ± 6,93	44,38 ± 1,01	2,23 ± 0,05	2,14 ± 0,01

TPC-total phenolic content (mg GAE/100 g); CT-total condensed tannins (mg CE/100 g); ANT-total monomeric anthocyanins (mg Cy-3-gal/100 g); ABTS assay (mg TE/100 g), FRAP assay (g TE/100 g). Results are expressed as average ± STDEV.

CONCLUSION

Cultivar selection has a stronger influence on the phytochemical composition and antioxidant potential than hydrocolloid addition. Nevertheless, the choice of hydrocolloid is also important, as Arabic gum demonstrated the best ability to preserve bioactive compounds and antioxidant activity in 3D-printable cornelian cherry formulations.



faculty of
food technology
and biotechnology
University
of Zagreb



Funding sources: This work was supported by Karlovac University of Applied Sciences through an internal project: "Nutrition innovative three-dimensional 3D-esserts (HRID) – NextGenerationEU" and by the PRIMA Project „From Edible Sprouts to Healthy Food – Feed“ (Prima Call 2022, Prima Section 2 – Multi Topic 2022, Topic 2.3.1 (RIA) Enabling the transition to healthy and sustainable dietary behaviour) (HORIZON 2020 Programme)



VELEUČILIŠTE U KARLOVCU
Karlovac University of Applied Sciences