UTILIZATION OF FRUITS POMACE IN MUESLI PRODUCTS

Lilla Szalóki-Dorkó, Hering Melitta, Mónika Máté

Department of Fruit and Vegetable Processing Technology, Institute of Food Science and Technology, Hungarian University of Agriculture and Life Science, H-1118 Budapest, Villányi út 29-43, Hungary
e-mail: Szaloki-Dorko.Lilla@uni-mate.hu

Abstract

Utilization of different fruit by-product was investigated during muesli products development. Sour cherry, cherry and black currant and apple pomace (4 g) was added to the samples besides the other used muesli ingredients such as oat, oil seeds, dried raisin, honey, coconut oil. In this study total polyphenol, total antioxidant (FRAP) content was measured of the mueslis with spectrophotometric methods, furthermore sensory analysis was done to evaluate the consumer acceptance. During our work four muesli products were created using different recipes. Muesli 3 showed the highest total polyphenol (2723.3 mg GAE mg/100 g) and FRAP (10.43 µg/100g) values due to high amount of fruit pomace. The muesli 4 contained the lowest concentration of bioactive compounds. As regard the overall impression of sensory analysis that provides information about the whole acceptance, sample 3 get the highest value (95%). Sample 4 was the next with 85% of overall impression and sample 1 was the third with 73% while the sample 2 was the last in the ranking. Fruit pomace has a great potential due the high bioactive compounds and appropriate sensory properties in aspect from muesli production.

Introduction

The fruit production has increased continuously in the world in the last decade [1]. Along with this large amount of fruit by-products were generated during the fruit processing technologies. The largest proportion of this is the pomace which is rich in bioactive components, dietary fibre, polysaccharides, vitamins etc. and the consumption of it has a health benefit in human nutrition [2; 3; 4]. Therefore, it has become important parts of scientific research and the novel food developments [5].

There are several studies about utilization of fruit pomace. For recovery of bioactive compounds, different solvents-based extraction has been used however other novel techniques including membrane-based methods, ultrasound-assisted and microwave-assisted extractions, high hydrostatic pressure, nanotechnology etc. have higher efficiency against to the conventional method [6; 7]. Fruit pomace can also be utilized for animal feeding, however, due to the low amount of protein it is not present high quality [8]. Furthermore, it can be used as effective functional ingredient for development of fibre in cereal-based products [9].

The aim of this study was to utilize different fruit by-product in muesli product. Muesli samples were created with ca. 5–20% pomace content to replace the fruit furthermore apple pomace was added to increase the fibre content of the samples. However, further objective was to create products with muesli-like sensory properties.

Experimental

Materials

Three differential pomace of fruits were used for muesli product development, namely sour cherry (‘Cigánymeggy’), sweet cherry (‘Szomolyai fekete’) and black currant. These were generated after pressing during the processing technologies. Each pomace contained moisture; therefore, they were condensed together to ca. 40 °Brix before using. To increase the fibre content of the muesli product apple pomace was used, which also a by-product of the apple

processing. The other ingredients of the muesli were the most used components, namely oat, oil seeds (pumpkin seed, sunflower seed), dried raisin, honey, coconut oil.

Methods

Muesli preparation

Four different samples of muesli were prepared under laboratory conditions using similar ingredients to the commercially available fruit muesli bar. The main components were oat, fruit pomace and oil seeds while raisin, honey and coconut oil were used in lower amount. After preparing, muesli samples were baked for 15–20 min at 140°C until solidifying.

Measuring methods

To determine the polyphenol components and antioxidant capacity, extraction was necessary for the analysis of the muesli samples. Samples were homogenize using knife blender and 3 g was weight to a centrifuge tube then 30 mL extraction solvent (60% methanol, 39% distilled water, 1% formic acid) was added. Samples stand for 15 minutes and were centrifuged at 4500 rpm for 5 minutes. The supernatants were used for spectrophotometric measurements and colour measurement.

Total polyphenol content (TPC) was determined according to the method of Singeton and Rossi [10]. The samples were measured at 760 nm and the results were given in mg gallic acid equivalent/100 g (mg GAE/100 g).

Total antioxidant capacity (FRAP) was determined using Benzie and Strain method [11]. The extract of mueslis was measured at 593 nm and the results were expressed in mg ascorbic acid equivalent/100 g (mg AAE/100g).

Sensory analysis was performed using 100 points system to evaluate the muesli samples based on these main properties: taste (max. 30 points), odour (max. 10 points), texture (max. 20 points), colour (max. 20 points) and overall impression (max. 10 points).

T-test was used for analysis of difference between the muesli samples in case of TPC and FRAP. Significant difference was considered when P value was <0.05.

Results and discussion

The final recipe of four different muesli samples can be seen in the Table 1. The difference between the sample 1 and sample 2 is the form of the oil seeds, because oil seeds were grounded in sample 2 to reach smoother texture. The quantity of fruit pomace was 34 g except in case of sample 3, in which 65.2 g was added to create a muesli product with high fruit content.

Table 1. Ingredients of muesli products

Ingredients	Quantity of ingredients (g)			
	Sample 1	Sample 2	Sample 3	Sample 4
Oat	55.0	55.0	32.0	55.0
Pumpkin seed	16.0	16.0	9.2	16.0
Sunflower seed	8.0	8.0	4.6	8.0
Honey	6.0	6.0	5.0	22.0
Coconut oil	11.0	11.0	–	11.0
Dried raisin	–	–	–	12.0
	Fruit pomace			
Sweet cherry	12.0	12.0	20.5	9.0
Sour cherry	12.0	12.0	20.5	9.0
Black currant	6.0	6.0	20.5	–
Apple pomace	4.0	4.0	4.0	4.0

Black currant pomace was missed from sample 4 to avoid the bitter, acrid taste, however it contained dried raisin. In general, all mueslis were sweetened with honey while coconut oil provided the cohesion between the ingredients. In addition, 4 g apple pomace was added to increase the fibre content of the samples. The final muesli products can be seen on the Figure 1.

Figure 1. Muesli product

The polyphenol content of the muesli samples can be seen on the Figure 2. Muesli 3 had the highest values (2723.3 mg GAE mg/100 g) as we expected because this sample contained the highest amount of fruit pomace. The muesli 1 contained by 40% lower value while ca. by 60% lower values were measured in muesli 2 and 4 compared to the sample 3. In case of muesli 2 and 4 similar results were detected however the fruit proportion was the half in muesli 4. This was probably due to the higher amount of honey (22 g). The differences between the TPC values of sample 3 compared to other samples were significantly lower.

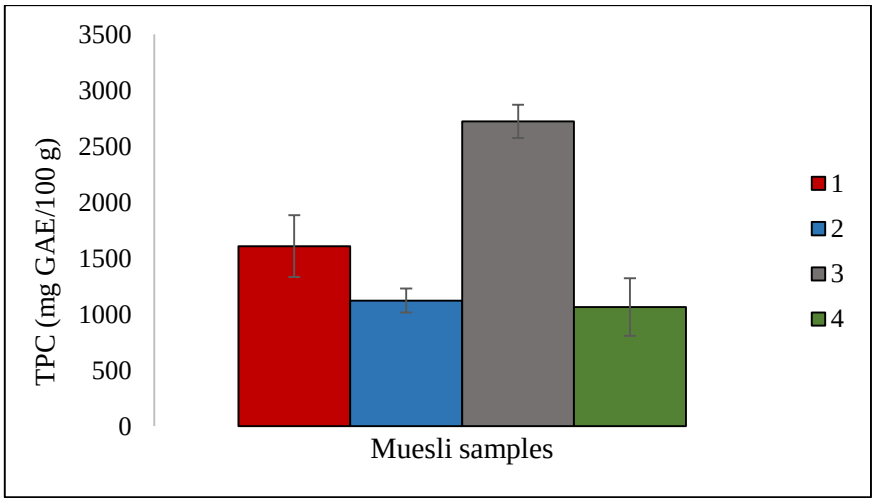

Figure 2. Total polyphenol content (TPC) of four muesli samples

The total antioxidant capacity (FRAP) of the samples showed almost similar tendency as considered in the case of TPC (Figure 3), however the sample 4 had lower value. Muesli 3 showed the highest content (10.45 µg AAA/100 g) which is higher by 50% than the sample 1 and almost higher with 66% than sample 2. The differences between the TPC values of sample 3 compared to other samples were significantly lower. The correlation between the results of TPC and FRAP is 0.9923 value which indicates very strong relationship.

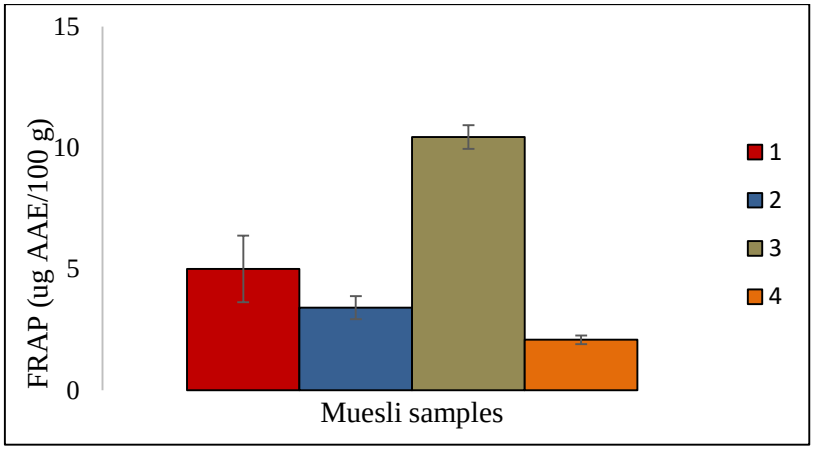

Figure 3. Total antioxidant capacity (FRAP) of four muesli samples

Based on the results of sensory analysis of muesli samples (Figure 3.) can be concluded that the sample which contained higher amount of fruit pomace finished in the first place. This muesli (sample 3) had the highest value in case of taste (90%), overall impression (95%), and odour (75%). The two least liked muesli were samples 1 and 2, however all values were above 60% in both cases. As regard the overall impression that provides information about the whole acceptance, after sample 3, sample 4 was the next with 85% and sample 1 was the third with 73% while the sample 2 was the last in the ranking.

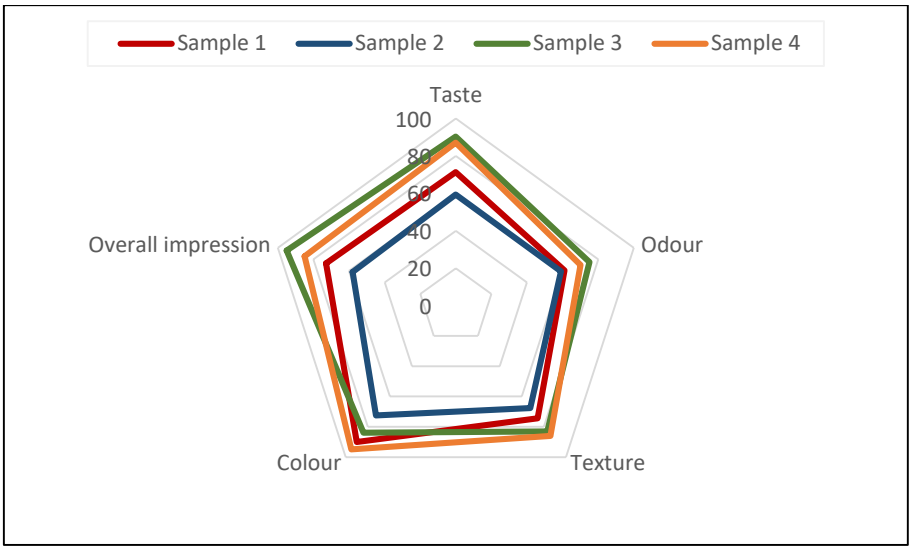

Figure 3. Sensory evaluation of muesli samples

Conclusion

Our study can reveal that the fruit waste generated from the processing industry can be used as an ingredient of muesli product. The sour cherry, cherry and black currant pomace have high content of bioactive compounds, so using as a food component of these waste materials is important way to utilize them. All created muesli samples have very good consumer acceptance and muesli-like properties base on the sensory evaluation.

References

[1] Global production of fresh fruit from 1990 to 2020. https://www.statista.com/statistics/262266/global-production-of-fresh-fruit/ (20 October 2022)
[2] E.-R. Lee, G.-H. Kang, S.-G. Cho, Recent Pat. Biotechnol. 1 (2007) 139–150.
[3] M. Karwacka, K. Rybak, M. Świeca, S. Galus, M. Janowicz, Sustain. 14 (2022) 13012.
[4] Y. Galali, Z.A.Omar, S.M. Sajadi, Food Sci. Nutr. 8 (2020); 8: 3004– 3022.
[5] J. Majerska, A. Michalska, A. Figiel, Trends Food Sci. Technol. 88 (2019**)** 207–219.
[6] C. Sabater, V. Sabater, A. Olano, A. Montilla, N. Corzo, Food Hydrocoll. 98 (2020) 105238
[7] E. Gençdağ, A. Görgüç, F.M. Yılmaz, Food Rev. Int. 34 (2021) 447–468.
[8] D.A Campos, R. Gómez-García, A.A. Vilas-Boas, A.R. Madureira, M.M. Pintado, *Molecules* 25 (2020**)** 320.
[9] A. Quiles, G.M. Campbell, S. Struck, H. Rohm, I. Hernando, Food Rev. Int. 34 (2006) 162–181.
[10] V. Singleton, J. Rossi AJEV 16 (1965) 144–158.
[11] I.F.F. Benzie, J.J. Strain, Anal Biochem. 239 (1996) 70–76.