THE IMPACT OF BERRY POWDERS ON THE QUALITY PARAMETERS OF FUNCTIONAL FOOD PRODUCTS

IMPACTUL PUDREI DIN FRUCTE DE PĂDURE ASUPRA PARAMETRILOR DE CALITATE A PRODUSELOR ALIMENTARE FUNCȚIONALE

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Abstract: În prezent e*xistă un interes crescut pentru fructele de pădure, deoarece acestea se caracterizează printr-o suprafață mare de cultivare și sunt bogate în antioxidanți, vitamine și minerale importante din punct de vedere nutrițional. Fructele de păducel și măceș sunt un concentrat natural de vitamine (C, P, B1, B2, E, K), carotenoizi, acid folic, uleiuri volatile etc. A fost efectuată investigarea capacității antioxidante a pudrelor și analiza impactului compușilor biologic activi asupra parametrilor de calitate ai produselor funcționale. Rezultatele obținute prin analiza diferitelor metode de cercetare au constatat că produsele alimentare funcționale îmbogățite cu antioxidanți naturali se caracterizează prin parametri de calitate înalți comparativ cu probele care nu au fost îmbogățite cu antioxidanți naturali.*
Key words: *păducel, măcețe, capacitate antioxidantă, produse funcționale*

Abstract: *There is an increased interest for berries because they are characterized by a large area of cultivation and they are rich in nutritionally important antioxidants, vitamins and minerals. The hawthorn and rosehip berries are natural concentrate of vitamins (C, P, B1, B2, E, K), carotenoids, folic acid, volatile oil, etc. Were performed the investigation of the antioxidant capacity of the powders and the analysis of the impact of the biologically active compounds on the quality parameters of the functional products. Results obtained through analysis of different methods of research has found that functional food products enriched with natural antioxidants are characterized by higher quality parameters compared to samples that were not enriched with natural antioxidants.*
Key words: *hawthorn, rosehip, antioxidant capacity, functional food products.*

Introduction

Nowadays there is an increased interest in berries because they are characterized by a large area of cultivation and they are rich in nutritionally important antioxidants, vitamins and minerals [1].

Studies on berry powders are increasing such as it becomes a potential ingredient rich in biologically active compounds for functional food products. The association of rosehip and hawthorn berries and the prevention of cardiovascular disease and cancer are justified by the rich content of antioxidants (carotenoids, vitamin C) and phytonutrients [2,3].

In this research, we studied mainly local berries such as rosehip (Rosa canina) and hawthorn (Crataegus).

The aim of this study is to evaluate the impact of berry powders on the quality parameters of functional bakery products. For this purpose, it is intended to study the amount of biologically active compounds and antioxidant activity of local berry powders and to investigate their impact for the physico-chemical and sensory characteristics of functional bakery products.

Doughnuts are the most popular bakery food products consumed worldwide at all economic levels. This is mainly due to their ready-to-eat nature, their availability in different varieties, and affordable cost. [4].

The objective of this research was to evaluate the effects of incorporating an amount (5 %) of rosehip (RP) and hawthorn (HP) powder on the quality of doughnuts in the making process.

Research Methodology

RP and HP Preparation

Fully mature rosehip (Rosa Canina) and hawthorn (Crataegus) berries were oven-dried by convection at 55 ± 1 °C for 30 h. The dried berries was milled and sieved to obtain a thin powder, and stored at +4°C until use. The chemical characteristics of obtained RP and CP powders are shown in Table 1.

Preparation of RP and HP lipophilic extracts

The extraction was carried out in deodorized refined sunflower oil with a solvent ratio of 1 g plant: 10 ml of oil. The extraction process was carried out by shaking at 22 ° C for 24h. The extracts were decanted and stored in dark glass bottles at + 4 ° C until use.

Preparation of Doughnuts

The doughnut formulation contained the ingredients typically used for doughnut preparation: 49,0 % wheat flour; 8,0 % sugar; 0,95% dry yeast; 5,40 % butter; 8,64 % eggs; 0,006 % salt (weight basis). RP and CP pomaces were incorporated into the muffins at 0 and 5% (w/w) by replacing an equivalent amount of wheat flour in the doughnut mixture. The dough was formed into round shape pieces and deep-fried in pre-heated vegetable oil for a total frying time of 90 seconds. After baking, the doughnuts were cooled to room temperature and packed in polypropylene pouches. They were then sealed until sensory and physico-chemical analysis was performed.

Determination of the total content of carotenoids

For the determination of the content of assimilating pigments, was measured the absorbance at wavelengths of 663 nm for chlorophyll a, 647 nm for chlorophyll b and 470 nm for total carotenoids, to 10 ml of extract versus the deodorized refined oil (blank). The carotenoid content were determined by the following equations [5]:

$$C_a(mgL^{-1}) = (12{,}25 \times A_{663.2}) - (2{,}79 \times A_{646.8}) \quad (1)$$

$$C_b(mgL^{-1}) = (21{,}5 \times A_{646.8}) - (5{,}1 \times A_{663.2}) \quad (2)$$

$$C_{a+b}(mgL^{-1}) = \frac{(1000 \times A_{470} - 1.82 \times C_a - 85.02 \times C_b)}{198} \quad (3)$$

where:

$A_{663.2}$ – solution absorbance at λ = 663.2 nm;

$A_{646,8}$ – solution absorbance at λ = 646.8 nm;

A_{470} – solution absorbance at λ = 470 nm;

Antioxidant activity determination using free radical DPPH

Determination of the antioxidant activity of the lipophilic extracts was performed using HACH LANGE DR-500 spectrophotometer and expressed as a % inhibition of DPPH using the following equation [6]:

$$AA\% = \frac{A_0 - A_t}{A_0} \times 100\% \quad (4)$$

where:

A_0 – absorbance of the DPPH solution at t = 0 s;

A_t – absorbance of the DPPH solution after 30 min;

A lower value of A_t in the analyzed sample shows a higher antioxidant activity.

Determination of polyphenol content

The reaction with Folin-Ciocalteu reagent was used to determine the total polyphenol content. For analysis in a 10 ml graduated flask, 5 ml of double-distilled water, 1 ml of analyzed sample and 0.5 ml of Folin-Ciocalteu reagent are assayed and shaken. After 3 minutes, 1.5 ml of sodium carbonate (10%) were added and top up with double-distilled water. The obtained solution was placed on the water bath at 50 °C for 16 minutes, then cooled to room temperature. The absorbance of the extracts was read on the "HACH LANGE D-5000" spectrophotometer at λ = 765 nm against double-distilled water. Results for the total polyphenol content, expressed in mg GAE/100 g of signed plant were obtained using the Gallic acid calibration curve [7].

Fat extraction

Extraction of fat was carried out following by using Soxhlet apparatus. About 5 grams of each sample was weighed accurately and transferred in an paper extraction thimble. The thimble was closed and placed in the extractor and the extractor was connected to a weighed flask containing 200 ml hexane. The extractor was connected to a reflux condenser and fat was extracted under reflux, on a water bath for six hours. The flask was dried in an air-oven at 40-60°C for one hour, cooled in a dessicator and re-weighed. The step of weighing was repeated until the results of two successive weighing do not differ by more than 0.1% of the

mass of the test portion [8]. The total content of fat was calculated by using a formula as follows:

$$Fat(\%) = \frac{W - W_0}{S} \times 100$$

W = Weight (g) of flask with fat
W_0 = Weight (g) of flask without fat
S = Weight (g) of sample before drying

Sensory evaluation

A sensory evaluation of doughnut samples was conducted after preparation. Sensory characteristics: taste, flavour, color, aspect, porosity and overall acceptability were evaluated by a 20-member panel on 5-point scale, with 1 being the lowest and 5 the highest according to Juyun Lim, (2011) [9].

Discussions

The results obtained in the present study argue the obtaining of the lipophilic extracts which provide a high extraction degree in the case of lipophilic compounds.

In order to study the impact of berry powders on the functional food product were determined the antioxidant activity, the total carotenoid content and total polyphenol content of the powders. The results obtained are presented in the table 1.

Table 1. Quality parameters of rosehip and hawthorn powders

Quality Parameters	Rosehip powder	Hawthorn powder
Antioxidant activity, %	78,67±0,01	62,19±0,01
Total carotenoid content, mg/L	17,83±0,05	10,29±0,01
Total polyphenol content, mg AG/100 g	760,55±0,65	470,90±0,89

The analysis of berry powders (RP and HP) with DPPH free radicals allows the evaluation of the antioxidant capacity of the biologically active compounds. The antioxidant capacity of the rosehip and hawthorn powders vary between 78,67…62,19±0,01%. The increased antioxidant activity of the powders is due to the physico-chemical composition, rich in carotenoids, vitamin C and phenolic compounds that have the ability to capture the free radicals. The total carotenoid content for the RP and HP vary between 10,29...17,83±0,05mg/L and the total polyphenol cotent vary between 470,90...760,55 mg AG/100 g.

To investigate further the quality parameters of enriched functional food products were prepared doughnut samples to a preset recipe.

The fat content were determined durring the frying process at 0, 15, 30 and 60 seconds in order to observe the fat acumulation in enriched samples compared to the blank sample. The results obtained are presented in the Figure 1.

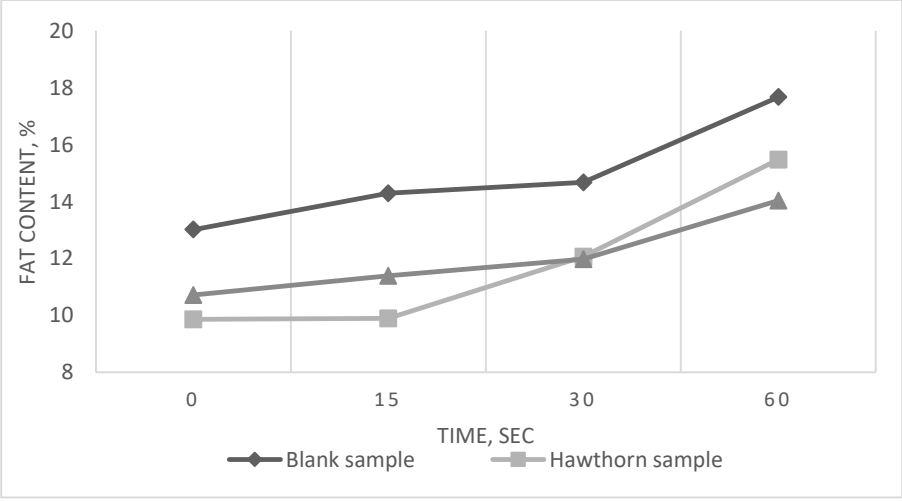

Figure 1. Fat content values during frying process.

It is observed that the highest amount of fat is characteristic for the blank sample

(13,01…17,67±0,03%) while for the rosehip sample the fat content varies between 10,71…14,03±0,03% and for the hawthorn sample values varies between 9,86…15,47±0,03%. The results obtained argue the fact that the berry powder addition to the food products decrease the absorption of fat during frying, which is an important factor for the quality of functional food products. The mechanism include the creation of a barrier through which moisture can not be easily released and subsequent oil absorption is reduced.

In order to analyze the organoleptic parameters was made a sensory evaluation and the results are shown in the figure 2.

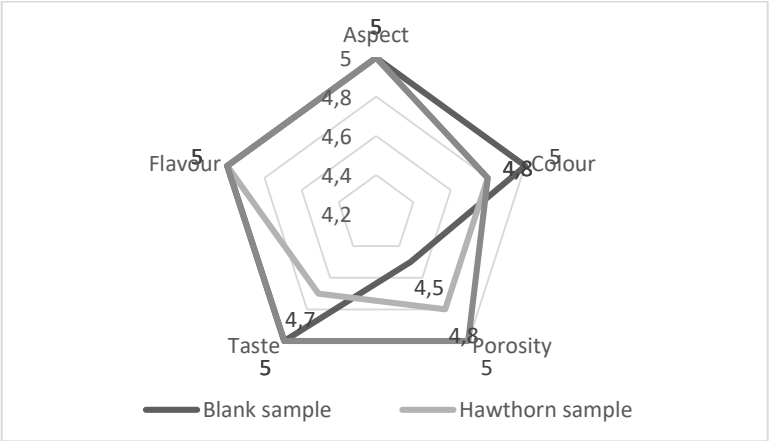

Figure 2. Sensory analysis of enriched functional food products

It was carried out that the samples prepared with the addition of rosehip and hawthorn powder are characterized by pleasant taste and flavour characteristic for doughnuts close to the blank sample. The aspect is homogeneous and very good. The color is characteristic for the product and vary according to the plant based addition. 5-point hedonic scale ranged from 4,70 to 5,00 for the studied functional food products.

Conclusions

Doughnuts enriched with rosehip and hawthorn powders represent good sources of antioxidants and biologically active compounds. Berry addition improved the quality parameters of functional food products by decreasing the amount of oil absorbed during deep-frying of the samples. The decrease of fat content appeared because of the high amount of biologically active compounds such as fibers, pectins, carotenoids etc. This research demonstrates the possibility to use local berry powders in the functional food products production. An important benefit is the possibility to use natural antioxidants and biologically active compounds obtained from local resources in order to substitute the synthetic ones. This way food products enriched with natural bioactive compounds will be safe and healthier for consumption.

Acknowledgments

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