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CONTENT OF BIOACTIVE COMPOUNDS AND ANTIOXIDANT CAPACITY OF PUMPKIN PUREE ENRICHED WITH JAPANESE QUINCE, CORNELIAN CHERRY, STRAWBERRY AND APPLES*

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Background. When evaluated in terms of taste, smell or active ingredients, pumpkin in itself is not very attractive as a raw material. Hence, it is recommended to blend pumpkin with other fruits, which are aromatic, have a defined taste, and contain a large quantity of active ingredients and organic acids to improve its palatability.

Material and methods. The pumpkin chosen for the experiments was of the variety Karowita, of species *Cucurbita maxima.* Ten different of compositions were prepared for the purpose of the study: 10, 20 and 30% (w/w) of Japanese quince and cornelian cherry each, or 20 and 30% (w/w) of strawberry and apple each. The puree was then analysed for dry matter, extract, viscosity, colour, vitamin C, total polyphenols, carotenoids and DPPH.

Results. The highest content of vitamin C, which was in direct proportion to the quantity of the supplement added (17.88 to 23.43 mg·100 g^{-1}), was detected in the quince-enriched puree. The lowest vitamin C content was determined in apple-enriched samples (1.36 to 1.6 mg·100 g^{-1}). A similar pattern was observed with total polyphenols: the highest values were measured in quince-enriched puree, and the lowest in the puree supplemented with apple.

Conclusion. Taking into account antioxidant properties of the samples, quince-enriched pumpkin puree was found to be the most attractive, and apple-enriched pumpkin puree the least attractive one. The results suggest a wide range of application for pumpkin puree enriched with various additives.

Key words: pumpkin puree, total polyphenols, vitamin C, antioxidant activity

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INTRODUCTION

Foods produced from plants abounds with natural biologically active compounds, such as polyphenols, vitamin C or β-carotene, have their antioxidant properties, are of great value to human health. It is considered that adequate level of antioxidants supplied with diet induces immunological processes and increases defensive abilities of cell in proper way [Prior 2003, Kalt 2005]. A well-balanced diet that will strengthen the immune system is now of great significance.

There is an increasing tendency among consumers to consume food products of a high nutritional value, even if they are not very popular. These days, the vegetable market offers a wide spectrum of products, among which pumpkin preserves have become increasingly popular. Customers seem to have realised that pumpkin has ornamental, as well as nutritive value, so they are beginning to appreciate the significance of pumpkin as a healthy and valuable component of various meals. Pumpkins are regarded as valuable vegetables primarily because of the high carotenoid content, and the low energetic value. Hence, it has become a highly valued component of slimming diets. The component of pumpkin regulates metabolism, as well as exerts a detoxifying and slightly dehydrating effect. It is also believed to protect against occurrence of cancer in humans [Astorg 1997].

Many health-promoting properties of pumpkin have outrun the majority of vegetables. Pumpkin itself is a high-yield vegetable, easy to grow, and, consequently, inexpensive. Changes in colour, flavour and viscosity that occur in the course of thermal processing affect the palatibility of a pureed product [Dutta et al. 2006].

Pureed pumpkin with no additives is bland and has a specific unacceptable flavour. It seems therefore recommendable to supplement pumpkin with other pureed raw materials in order to attain the organoleptic properties desired and, additionally, to upgrade the bioactivity of the product.

The aim of the study was to examine how the enrichment and palatibility of the pumpkin puree with other pureed fruits in different proportions will enhance the bioactive compounds of the product. Samples of pureed pumpkin of the variety Karowita, with and without enrichment by Japanese quince, cornelian cherry, strawberry or apple, were analysed for chemical parameters, colour and antioxidant capacity.

MATERIAL AND METHODS

Material. Two types of Karowita pumpkin samples: pumpkin puree with no additives (control) and pumpkin puree enriched in different proportions with pureed Japanese quince, cornelian cherry, strawberry of the variety Elsanta or apple of the variety Boscoop. Karowita pumpkins were grown in the Experimental Station of Wroclaw University of Environmental and Life Sciences in Psary. Apples and strawberries were bought from local market, Japanese quince and cornelian cherries were collected in Wrocław area.

Sample preparations. Pumpkin, Japanese quince and cornelian cherry puree samples were prepared at the full stage of fruit maturity, immediately upon harvest time, and then frozen. Strawberry puree, was made of whole, frozen berries, pureed shortly before addition to the pumpkin puree sample. Apple puree samples were prepared from stored fruit, also pureed shortly before addition to the pumpkin puree. Pumpkin puree was prepared after harvest by mixing in a Thermomix TM (Vorverk) for 10 min at 90°C and was stored –18°C. Pumpkin puree was thawed to room temperature just before preparation of mixed purees. Cornelian cherry puree was prepared by mixing for 10 min at 50°C from frozen fruits. After that the stones were separated from the puree. During Japanese quince and apple puree preparations seeds were removed and soft part of the fruits was mixed for 10 min at 90°C. Strawberries were mixed in a Thermomix TM (Vorverk) for 2 min at 90°C. At the end the prepared purees were mixed together in proper compositions in a Thermomix TM (Vorverk) for 2 min at 90°C. Next the hot purees were poured into the jars and left to cool over night.

Ten variants of composition were prepared: 10, 20 and 30% of Japanese quince and cornelian cherry each, and 20 and 30% of strawberry and apple each. The puree samples prepared were stirred, subjected to heat treatment in a Thermomix TM (Vorverk) kitchen robot at 90°C for 2 min and hot-packed into jars. Then the puree was analysed for dry matter, extract, viscosity, colour, vitamin C, carotenoids, total polyphenols, and antioxidant activity (DPPH).

Analytical methods. Dry matter content was determined using the standard mention the AOAC 2001.12 [AOAC 2001]. The method entails drying at defined pressure and temperature until the sample attains a constant mass. In the present study the extract content was determined using a digital Pocket PAL-1 refractometer made by ATAGO (Japan). The measuring range of the apparatus was between 0 and 53 Brix degrees, with automatic temperature compensation ranging from 10 to 75°C.

Rheological measurements were performed with a rotational BROOKFIELD LV, DV-II-Pro viscometer. Approximately 20 ml of the pureed sample were placed in the concentric cylindrical cup. The measuring parameters applied were as follows: spindle no. 64, time – 30 s, shear rate – 20 rpm (except for the sample consisting of pumpkin and 30% Japanese quince, with 5 rpm). The results are expressed in Pa·s.

The colour of the pureed pumpkin samples (reflectance values: L*, a* and b*) was measured using a Color Quest XE (HunterLab) spectrophotometer. Each sample was placed in a glass cuvette, and the colour was recorded using CIE L*a*b* 10°/D65 colour spaces.

Colour measurements were taken in triplicate at three different places on the pouch and average values were used for calculation. The change in the colour of the pumpkin puree was evaluated through the total colour difference (ΔE) in terms of the following equation:

$$\Delta E = [(L0 - L)^2 + (a0 - a)^2 + (b0 - b)^2]\ 0.5$$

where L0, a0, and b0 represent the reading in the control sample (pumpkin puree with no additives), and L, a, b represent individual readings in fruit-enriched pumpkin puree samples [CIE 1986, Pasławska et al. 2010].

For the analysis of carotenoids use was made of the Polish standard PN-90/A--75101/12. In this method carotenoids are extracted from the sample with hexane and their content in the extract is determined by colorimetry at 450 nm. In the present study extinction was measured with a Spekol 11 (Carl Zeiss Jena) spectrophotometer at 450 nm, in the presence of hexane [PN-90/A-75101/12 1990].

Vitamin C was analysed according to PN-A-04019:1998 [1998]. The method consists in the oxidation of l-ascorbic acid to dehydroascorbic acid in an acid medium with a blue dye of 2.6-dichloroindophenol, followed by the reduction of the dye to the *leuko* (colourless) form, which takes on red colour at the pH of 4.2.

Extraction of polyphenol compounds for antioxidant activity analysis. An approximately 5 g portion of each puree was weighed in a test tube for antioxidant property analysis. A total of 25 mL of 80% aqueous methanol was added, and the suspension was stirred slightly. The sample was sonicated for 5 min and left at 4°C. After that the mixture was filtered using Schott funnels. The extracts obtained *via* this route were made subject to analysis. For the extraction of the samples with a cornelian cherry, strawberry or an apple additive use was made of 80% methanol treated with 1% HCl.

Total polyphenols were determined by the Folin-Ciocalteu [Slinkart and Singleton 1977] method, using gallic acid (GA) as a standard for the calibration curve. The results were read at 765 nm after 1 h in a Shimadzu UV-2401 PC spectrophotometer. All determinations were performed in triplicate. The results of the assay were calculated and expressed as milligrams of GA equivalent (GAE) per 100 grams of fresh weight (FW).

DPPH Radical Scavenging Spectrophotometric Assay. The DPPH radical scavenging activity of pumpkin puree was determined according to the method proposed by Yen and Chen [1995]. The supernatant (0.5 mL) was added to 0.5 mL of 0.2 mM DPPH ethanolic solution and 1.5 mL of ethanol. The mixture was shaken and left to stay at room temperature for 10 min. Antioxidant capacity was measured by recording absorbance at 517 nm in a Shimadzu UV-2401 PC spectrophotometer. Ethanol was used as blank. All determinations were performed in triplicate. The results of the assay were calculated and expressed as μmol of Trolox per 1 gram of fresh weight (FW).

Statistical analysis. The data obtained were made subject to statistical analysis performed using Statistica 8.0 (StatSoft Poland). They were recorded as means ±SD, and analysed by Excel 2007. Analysis of variance was performed by ANOVA procedures. Significant differences ($P \leq 0.05$) between the mean values were determined by Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

The values of dry matter, extract, viscosity, and colour parameters are presented in Table 1. As can be seen from these data, the dry matter content in the samples ranges from 10.3 to 14.21%. The highest and the lowest proportion of dry matter was measured in the sample with 30% enrichment by cornelian cherry and 30% enrichment by strawberry, respectively. The dry matter content in the control or different fruit purees need to be mentioned in the table; it accounts for 11.5%. The strawberry additive reduced the content of dry matter in contrast to the other additives which contributed to its increase. Is there any change in the dry matter content due to simple mixing?

As shown in Table 1, the highest level in total extract or water solubles was found in the pumpkin sample with 30% enrichment by cornelian cherry (11.15%), and the lowest in the control (7.2%). From this finding it can be inferred that all the additives applied brought about an increase in the total extract of the pumpkin puree. In their research onto fruit mousse as a source of natural antioxidants, Szajdek et al. [2007] measured extract levels in apple mousses enriched with additives which varied between 18.5 and 21.0%. These values are substantially higher than the ones obtained in our present study. The difference is to be attributed to the low extract level or high solids content in the control.

Table 1. Values of dry matter content, extract, viscosity and colour parameters of pumpkin puree with additives

Sample	Dry matter %	Extract %	Viscosity Pa·s	Colour ΔE
P	11.49 ±0.077[f]	7.2 ±0.071[g]	15.4 ±0.047[d]	0
Q10	12.23 ±0.077[d]	9.2 ±0.071[d,e]	21.8 ±0.092[c]	7.65 ±0.099[g]
Q20	12.17 ±0.226[d,e]	8.9 ±0.072[e]	24.0 ±0.219[b]	9.79 ±0.184[f]
Q30	12.78 ±0.077[c]	9.2 ±0.141[d,e]	101.2 ±0.523[a]	10.12 ±0.445[e]
C10	12.31 ±0.141[d]	9.8 ±0.073[c]	13.7 ±0.049[d]	17.83 ±0.007[c,d]
C20	13.34 ±0.014[b]	10.7 ±0.141[b]	14.6 ±0.049[d]	26.61 ±0.014[b]
C30	14.21 ±0.091[a]	11.1 ±0.035[a]	15.1 ±0.247[d]	30.59 ±0.290[a]
S20	10.84 ±0.113[g]	8.3 ±0.071[f]	8.3 ±0.035[e]	16.52 ±0.042[d]
S30	10.30 ±0.084[h]	8.4 ±0.071[f]	7.3 ±0.049[e]	18.11 ±0.141[c]
A20	11.96 ±0.014[e]	9.5 ±0.141[c,d]	13.4 ±0.481[d]	7.07 ±0.177[g]
A30	12.16 ±0.127[d,e]	9.0 ±0.072[d,e]	12.3 ±0.445[d]	9.42 ±0.544[f]

[a]Values (within columns) which have been assigned the same letters are not significantly different (Duncan's Multiple Range Test, $P < 0.05$).

P – pumpkin, Q – Japanese quince, C – cornelian cherry, S – strawberry, A – apple.

As shown in Table 1, the highest and the lowest viscosity value was measured in the pumpkin puree samples with 30% enrichment by Japanese quince and 30% enrichment by strawberry, respectively (101.2 Pa·s at 5 rpm and 7.3 Pa·s at 20 rpm, respectively). The viscosity of the control sample amounts to 15.4 Pa·s (20 rpm). The results of statistical calculations make it clear that the differences between the pumpkin puree in the control and the puree enriched with cornelian cherry (from 13.7 to 15.1 Pa·s) or apple (from 12.3 to 13.4 Pa·s) are insignificant in statistical terms. The quince additive significantly increased the viscosity of the puree samples (by 7.5 on average), contrary to the strawberry additive, which accounted for a significant reduction in viscosity (by 7.6 on average).

Colour is an important feature of the product assessed by the consumer. The criterion set up by the International Commission on Illumination (Commission Internationale de l'Eclairage, CIE) defines the ranges of total colour differences (ΔE). In the range of 0 to 1 the differences are not perceivable; between 1 and 2 there are slight differences perceivable to a person capable of distinguishing nuances of colours; the range of 2 to 3.5 includes moderately high differences, easily perceived even by an inexperienced observer; within the range of 3.5 to 5 distinct total colour differences are observed; values higher than 5 indicate large total colour differences [CIE 1986].

The colour parameters of the samples (CIELab system) are presented in Table 1. The lowest values of the total colour differences, ΔE, for additive-enriched pumpkin puree were measured in the samples with 20% apple supplement (7.07) and 10% quince supplement (7.65). These differences were easily perceived by an inexperienced observer. The greatest difference was observed in the pumpkin puree sample with a 30% cornelian cherry additive (30.59).

In the quince-enriched pumpkin puree the total colour difference between the sample with 20% enrichment and that with 30% enrichment amounted to 0.33 units, and was not perceived by experienced observers. The largest differences perceivable to observers even with very poor experience were found to occur in the samples with cornelian cherry additives (12.77), which is to be attributed to the high content of anthocyanins in the fresh fruit material used (cornelian cherry, strawberry). Additives rich in anthocyanins also noticeably changed the colour of the control sample.

Total carotenoids content in pumpkin is known to be strongly influenced by the temperatures of the vegetation period, by the conditions of cultivation, and more importantly, by the technological processes applied, specifically thermal processing [Biesiada et al. 2009, Kalt 2005]. The highest retention of carotenoids was obtained when vegetables were cooked almost without water and the lowest retention was associated with the use of a large amount of water during cooking [Leskova et al. 2006].

The content of total carotenoids in the samples examined within the scope of our present study varied between 4.9 and 7.4 mg·100 g^{-1} FW, the highest value being measured in the control (Table 2). This is why higher values were determined in the pumpkin puree samples enriched with lower proportions of particular additives. No statistically significant differences were found between the values measured in the control sample and those determined in the sample with 10% enrichment by cornelian cherry. A substantial reduction in the total carotenoid content (to 4.9 mg·100 g^{-1} FW) was observed in the sample where quince-enrichment amounted to 30%. It is essential to note that in our present study each of the starting materials used for pumpkin puree enrichment showed a lower total carotenoid content as compared to the pumpkin examined. This seems to be an adequate explanation for the reduced total carotenoid content in the composites obtained.

Table 2. Content of carotenoids, vitamin C and total pholyphenols, as well as the values of DPPH parameters, in pumpkin puree with additives

Sample	Carotenoids	Vitamin C	Total polyphenols	DPPH
		mg·100 g^{-1} FW		μmol Trolox·g^{-1} puree
P	7.4 ±0.03[a]	14.12 ±0.16[d]	23.64 ±0.56[i]	1.02 ±0.11 [f]
Q10	6.98 ±0.11 [b]	17.88 ±0.17 [c]	54.89 ±0.96 [e]	2.48 ±0.13 [c]
Q20	6.28 ±0.03 [c]	20.71 ±0.01 [b]	94.03 ±0.92 [b]	2.59 ±0.19 [c]
Q30	4.89 ±0.01 [f]	23.42 ±0.35 [a]	135.15 ±2.89 [a]	2.98 ±0.06 [b]
C10	7.27 ±0.04 a	14.30 ±0.01 [d]	35.31 ±0.28 [h]	2.85 ±0.10 [d,e]
C20	5.91 ±0.01 [d]	12.70 ±0.16 [e]	44.11 ±2.33 [f]	3.16 ±0.27 [b]
C30	5.32 ±0.04 [e]	10.72 ±0.18 [f]	60.58 ±2.21 [d]	3.79 ±0.12 [a]
S20	5.25 ±0.09 [e]	12.82 ±0.34 [e]	66.61 ±2.17 [c]	2.09 ±0.16 [d,e]
S30	5.86 ±0.07 [d]	14.55 ±0.35 [d]	60.75 ±0.11 [d]	2.54 ±0.14 [c]
A20	5.88 ±0.03 [d]	1.60 ±0.18 [g]	38.90 ±1.30 [g,h]	1.74 ±0.15 [e]
A30	5.45 ±0.06 [e]	1.36 ±0.17 [g]	40.77 ±2.76 [f,g]	1.81 ±0.13 [d,e]

[a]Values (within columns) which have been assigned the same letters are not significantly different (Duncan's Multiple Range Test, P < 0.05).

P – pumpkin, Q – Japanese quince, C – cornelian cherry, S – strawberry, A – apple.

Compared with other major fruit and vegetable antioxidants, ascorbic acid is more susceptible to significant loss during postharvest handling and storage. Also processing, can result in oxidation, thermal degradation, leaching and other events that lead to lower levels of antioxidants particularly vitamin C in processed food compared with fresh [Kalt 2005, Lathrop and Leung 1980].

As can be seen from the data in Table 2, the concentrations of vitamin C in the pumpkin puree varied largely among the samples examined, falling between 1.36 and 23.42 mg·100 g^{-1} FW whereas according to Biesiada et al. [2009] in fresh pumpkin fruit Karowita cv content of this vitamin varied from 22.1 to 31.5 mg·100 g^{-1} FW depending on method of nitrogen fertilization. The poorest vitamin C content, 1.36 and 1.6 mg·100 g^{-1} FW, was measured in the puree pumpkin samples enriched with 20% and 30% apple additives, respectively. These values were also the lowest ones determined in the course of the study (including the control sample), which is to be attributed to the low concentration of vitamin C in the apple variety used. The polyphenol oxidase activity in Boscoop variety is a very high. After destruction of apple tissue enzymatic oxidation reaction starts. Vitamin C is degraded in the first place and then chinones are formed from the phenolic compounds. The chinones are very reactive and easily react with other phenolic compounds and ascorbic acid, if available, for example from pumpkin puree after mixing with apple mash [Zimmer 1999, Markowski and Płocharski 2006]. This is probably a reason for such great decrease of vitamin C content in apple-pumpkin purees, compared to the rest of puree samples. As far as the other pumpkin puree samples are concerned, the lowest content of vitamin C was determined when pumpkin was enriched with the 30% cornelian cherry additive (10.72 mg·100 g^{-1} FW); the highest vitamin C content being found in quince-enriched samples (17.88, 20.71 and 23.42 mg·100 g^{-1} FW for 10%, 20% and 30% additive, respectively). Vitamin C concentration in the control sample amounted to 14.12 mg·100 g^{-1} FW.

The results demonstrate that quince-enrichment (regardless of the proportion added) accounted for a noticeable increase in the content of vitamin C. Upon 10% enrichment with cornelian cherry and 30% enrichment with strawberry, vitamin content increased only slightly, and the increase was statistically insignificant. The other additives significantly reduced the content of vitamin C in the pumpkin puree examined.

Methods of culinary preparation also have a marked effect on the polyphenol content of foods. For example, simple peeling of fruit and vegetables can eliminate a significant portion of polyphenols because these substances are often present in higher concentrations in the outer parts rather than in the inner parts [Manach et al. 2004]. Grinding of plant tissues may lead to oxidative degradation of polyphenols as a result of cellular decompartmentation and contact between cytoplasmic polyphenol oxidase and phenolic substrates present in the vacuoles. Polyphenols are then transformed into brown pigments that are polymerized to different degrees. This unwanted process can occur, for example, during the process of making jam or compote from fruit [Macheix and Fleuriet 1998]. Losses in total phenolic content after blanching and long term frozen storage ranged from 20% to 30%. [Puupponen-Pimiä et al. 2003]. Like vitamin C, phenolic antioxidants are water soluble and can be leached from fruit and vegetable tissues by processing in water [Gil et al. 1999].

The content of polyphenols was found to differ considerably among the samples examined, ranging from 23.64 to 135.15 mg GAE·100 g^{-1} FW (Table 2). The lowest value was measured in the control sample without additives (23.64 mg GAE·100 g^{-1} FW). Any enrichment of the pumpkin puree raised the polyphenol content in the final product.

The highest values, 94.03 and 135.15 mg GAE·100 g^{-1} FW, were measured at 20% addition and 30% addition of quince, respectively. At 10% addition, the content of polyphenols in the final product was markedly lower, as it amounted to 54.89 mg GAE·100 g^{-1} FW only. The lowest total polyphenol content (35.31 mg GAE·100 g^{-1} FW) was determined in the pumpkin puree with a 10% cornelian cherry additive.

The richest source of natural antioxidants are fresh fruit and vegetables, but processing procedures can considerably diminish antioxidant activity of the product in comparison to raw materials. However, at the same time there are some reports on an increase in polyphenol concentration as a result of thermal processing of raw material, e.g. in broccoli, peppers, spinach or beans [Turkmen et al. 2005]. According to literature data carrot proved to be a source of stable natural antioxidants, as the antioxidant activity of its extracts did not change during 15-day storage at 5 and 25°C, or in the course of heating (15 min, 100°C) [Arabshahi et al. 2007]. High stability or increased antioxidant activity of foodstuffs undergoing thermal processing results from formation of compounds exhibiting antioxidant properties [Nicoli et al. 1999, Talcott et al. 2000].

In our study antioxidant activity (determined by the DPPH method) varied between 1.02 and 3.79 µmol Trolox·g^{-1} puree, the lowest values being measured in the control sample (Table 2). The highest values were obtained for the puree samples with a 20% additive and 30% additive of cornelian cherry (3.16 µmol Trolox·g^{-1} puree and 3.79 µmol Trolox·g^{-1} puree, respectively). With a 10% cornelian cherry additive, DPPH activity amounted to 2.85 µmol Trolox·g^{-1} puree. The antioxidant activity values of the quince-enriched pumpkin puree varied between 2.48 and 2.98 µmol Trolox·g^{-1} puree, showing less distinct differences as compared to those observed in the case of the cornelian cherry additive. The differences in the antioxidant activity among the samples are attributable to the fruit varieties used as additives.

CONCLUSION

The study on the enrichment of pumpkin puree with quince, cornelian cherry, strawberry or apple in different proportions has produced the following results. Any of the fruits examined can be used as an enriching additive, but quince is the most attractive and shows a great promise as a supplement. A 30% enrichment with quince increased the content of polyphenols in the product. The quince-enriched samples were also characterised by the highest content of vitamin C, the highest antioxidant activity, and the highest value of lightness. Pumpkin puree with 30% enrichment by the cornelian cherry additive displayed the highest extract value, but the colour of the product was not very attractive. The poorest enrichment in health-promoting parameters was obtained with the apple additive. The apple supplement considerably reduced the content of vitamin C as compared to that in the starting puree (pumpkin with no additive).

The obtained purees could be used as a component of nectars, smoothies, puree products for children or simply as a pumpkin based purees.

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ZAWARTOŚĆ ZWIĄZKÓW BIOAKTYWNYCH I WŁAŚCIWOŚCI PRZECIWUTLENIAJĄCE PRZECIERÓW Z DYNI WZBOGACONYCH PIGWOWCEM, DERENIEM, TRUSKAWKAMI I JABŁKAMI

Wstęp. Dynia jest stosunkowo mało atrakcyjnym surowcem pod względem smaku, zapachu i związków aktywnych. Dlatego celowe wydaje się mieszanie tego surowca z innymi owocami, które są aromatyczne, o bardziej zdecydowanym smaku i dużej zawartości związków aktywnych oraz kwasów organicznych.
Materiał i metody. W badaniach określono właściwości antyoksydacyjne przecierów uzyskanych z dyni odmiany Karowita, należącej do gatunku *C. maxima*, z dodatkiem owoców: pigwowca, derenia, truskawek i jabłek. Przygotowano 10 wariantów mieszanek: z 10-, 20- i 30-procentowym dodatkiem pigwowca i derenia oraz 20- i 30-procentowym dodatkiem truskawek i jabłek. Wykonane wcześniej przeciery mieszano i rozparzano przez 2 min w temperaturze 90°C w termomiksie oraz rozlewano na gorąco do słoików. W przecierach oznaczano suchą masę, ekstrakt, lepkość, barwę, witaminę C, polifenole, karoteny oraz właściwości antyoksydacyjne (DPPH).
Wyniki. Lepkość badanych przecierów cechowała bardzo duża różnorodność – od 101,2 Pa·s (przy 5 rpm) do 7,3 Pa·s (przy 20 rpm). Największą lepkość wykazał przecier z 30--procentowym dodatkiem pigwowca, a najmniejszą – przecier z 30-procentowym dodatkiem truskawek. Jasność w systemie CIElab przygotowanych przecierów wahała się w zakresie od 39,6 do 60,1. Najciemniejsze były przeciery z dodatkiem derenia, a najjaśniejsze – z pigwowcem. Zawartość witaminy C była największa w przecierach z pigwowcem, natomiast najmniejsza – w przecierach z domieszką jabłek. Podobnie przedstawiała się ilość oznaczonych polifenoli ogółem. Najlepsze właściwości antyoksydacyjne wykazały przeciery z dodatkiem derenia.
Wnioski. Ze względu na właściwości organoleptyczne oraz antyoksydacyjne, najatrakcyjniejsze okazały się mieszanki dyni z pigwowcem. Uzyskane wyniki wskazują na duże możliwości wykorzystania przecierów z dyni z użyciem różnych dodatków owoców. Uzyskuje się w ten sposób przeciery o dobrych właściwościach organoleptycznych i dużym stężeniu związków czynnych, które wykazują aktywność przeciwutleniającą.

Słowa kluczowe: przecier z dyni, polifenole ogółem, witamina C, aktywność przeciwutleniająca, barwa

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