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Quality of Pumpkin Cultivars in Relation to Sensory Characteristics

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Abstract

The aim of this work was to investigate nutrition value and sensory characteristics of pumpkin fruits of different cultivars of the species *Cucurbita pepo* L., *C. maxima* Duch. and *C. moschata* Duch. ex Poir., of Poland, Lithuanian or Russian origin. The cultivars chosen were: 'Miranda', 'Kustovaja' 'Zalushka', 'Bambino', 'Kroshka', 'Lecebnaja', 'Zemcuzina'. Pumpkins were grown in the experimental field of Warsaw Agricultural University. Chemical analysis of pumpkin fruits were performed with standard methods. There were determined: dry matter, soluble solids content, total carotenoids content, nitrates content, colour of flesh, antioxidant activity (with DPPH method). Sensory quality was determined with quantitative descriptive method (QDA). Correlation coefficients between chosen quality parameters were calculated and multiple regression model to overall sensory quality was applied. Results show big differentiation in quality parameters determined. 'Kroshka' was the cultivar of highest carotenoids content and of the highest antioxidant activity. The cultivars of the highest content of soluble solids were 'Kroshka' and 'Bambino'. Significant relationship between carotenoids content and antioxidant activity of pumpkin fruits was found.

Keywords: *Cucurbita pepo, Cucurbita maxima, Cucurbita moschata,* pumpkin, carotenoids, antioxidant activity, nutrition, sensory quality, vegetables

Introduction

Pumpkin is one of the vegetables that meet the requirements of healthy nutrition. It is a tasty and valuable vegetable crop, containing a lot of biologically active substances and distinguished for dietary qualities. The name 'pumpkin' is commonly used for cucurbits of some species, similar in botanical characteristiscs. In Central Europe countries pumpkins belonged to *Cucurbita pepo* L. (called also 'squash'), *Cucurbita maxima* Duch. (called 'winter squash') and *Cucurbita moschata* Duch. ex Poir species are mostly grown. Since pumpkin species and cultivars differs in nutritional and technological value of fruits, breeders and scientists seek genotypes of the highest suitability for human nutrition.

The quality of vegetables consists of some properties, which can be evaluated using physical and chemical methods (Abbott, 2001). One of important quality traits of food is biological activity of a product, and especially its antioxidative activity. Antioxidants are compounds that protect cells against the damaging effects of reactive oxygen species. Some of antioxidant agents are found in vegetables. Products high in vitamin A, vitamin C, vitamin E, and beta-carotene content are believed to be the most beneficial. Carotenoids are red, orange or yellow fat-soluble plant pigments. These nutrients are commonly found in fruits and vegetables, those with the strongest colors being healthiest (Palace et al., 1999). In human organism, carotenoids play two primary roles: exert antioxidant activity, but some are also converted into the vitamin A. Of the 600 carotenoids that have been identified, about 30 to 50 are believed to have vitamin A activity. The best known of this group are β-carotene and α-carotene. At present, there is no officially recommended dietary intake of carotenoids, but recommended dietary intake of vitamin A is about 1-3 mg per day of retinol equivalent (Murkovic et al., 2002). It is assumed that processing of vegetables improves the bio-availability of carotenoids, since it breaks down the cellulose structure of the plant cell (Van het Hoff et al., 2000).

Experimental studies suggest that a higher dietary intake of carotenoids offers protection against developing certain cancers (e.g., lungs, skin, uterine, cervix, gastrointestinal tract), macular degeneration, cataracts, and other health conditions linked to oxidative or free radical damage (Rock, 1997). Special physiological activity of these compounds in human organism as the vitamin A precursors and also as antioxidants, causes increasing interest among researchers in determining their content in different products (Palace et al., 1999).

Sensory evaluation of vegetables brings very valuable information on their quality characteristics. Sensory traits of vegetable are usually the main factor determining consumer's satisfaction (Abbott 1999). Among various sensory evaluation methods reported in literature, the QDA method (quantitative descriptive analysis) is usually applied for detailed description of sensory characteristics. In this method an assumption is done that sensory quality is a complex of many descriptors, which can be individually estimated by a consumer (Meilgaard et al., 1999; Chabanet, 2000). For the unification of sensory evaluation methods international standards were approved, based on ISO recommendations (Anonymous, 1996a, 1998, 1999).

Pumpkins, especially winter squash cultivars (*Cucurbita maxima* Duch.), are believed to be a good source of carotenoids. The main carotenoids, which are present in winter squash are α-carotene and β-carotene. Winter squash fruit contains 0.4-7.5 mg·100 g−1 of α-carotene and 1.4-8.4 mg·100 g−1 of β-carotene, depending on cultivar (Bushway, 1986). On the average pumpkins contain 6-8 % of dry matter, but the best cultivars accumulate up to 15-20% of dry matter (Bushway, 1986). In cultivars of *Cucurbita moschata*, total concentration of 19 carotenoids reaches 320 μg g-1, of which β-carotene accounts for 74% (Murkovic et al., 2002). Pumpkin cultivars of American origin contain (in raw fruits) 4.2 mg·100 g−1 of β-carotene and 0.8 mg ·100 g−1 of α-carotene (Holden et al., 1999). Other data show that in cultivars of American origin the content of β-carotene (in raw fruits) reaches 4.2 mg·100 g−1 and of α-carotene 0.8 mg ·100 g−1 (Holden et al., 1999; Wu et al., 2004). However, USDA reports (Anonymous 2003a, 2003b) show lower values - 0.8 mg ·100 g−1 of β-carotene and only 0.012 mg·100 g−1 of α-carotene. For Polish cultivars highest β-carotene content (about 12 mg·100 g−1) showed cultivar 'Amazonka' (Sztangret et al., 2004, Gajc-Wolska et al., 2005, Seroczyńska et al., 2006)). 'Amazonka'. 'Stofuntovaja' and 'Bambino' were the cultivars which are characterized by high dry matter content and, at the same time, high soluble solids content (Danilcenko et al., 2007). There was found quite strong correlation between carotenoids content and flesh colour of fruits (Seroczyńska et al., 2006).

The aim of this study was to determine nutritional and technological value of pumpkin cultivars of different origin and to find most valuable from nutritional and sensory points of view.

Materials and methods

Pumpkin plants were grown at the experimental field of Warsaw University of Life Sciences in 2007. Total 7 cultivars of Polish, Lithuanian and Russion origin were chosen for the experiment: 'Miranda', 'Kustovaja' 'Zalushka' *(Cucurbita pepo* L.), 'Bambino', 'Kroshka', 'Lecebnaja' (*Cucurbita maxima* Duch.), 'Zemcuzina' (*Cucurbita moschata* Duch. ex Poir.). All these cultivars are plants of the bushy growth, of big fruits, harvesting at physiologically mature stage. The soil in the field was alluvial loam. Acidity of the soil (pH) was close to neutral. The content of humus was 1.1%. The plants were grown from transplants, planting out in the middle of May. The fertilization was applied with the standard doses of N, P and K. The temperature and rainfalls during the vegetation season were close to normal for climatic conditions of central Poland. Fruits were harvested at the physiological maturity stage, at the beginning of October. Quality of fruits was evaluated after one-week storage of fruits at 12oC.

Dry matter was determined by drying the samples at the temperature of 105°C to a constant mass (ISO 751:2000). Carotenoids were extracted in hexane. Total carotenoids content was determined with spectrophotometrical method (Lichtenthaler and Wellburn, 1992). The column chromatography method was used for beta-carotene separation. Beta-carotene and total carotenoids content were determined with the spectrophotometer Shimadzu, using the wavelength 450 nm. Antioxidant activity was determined spectrophotometrically, according to Yen and Chen (1995), as the percent of DPPH (2,2-diphenyl-1-picrylhydrazyl) inhibition in fruit flesh methanol extract. Measurements were done after 10 minutes of reaction period, using the wave length 517 nm. Nitrates (NO3) content were determined by spectrophotometric method, with Fiastar device. Soluble solids content were determined with a refractometer, and expressed as Brix degrees (oBrix). Colour of fruit flesh was measured with a HunterLab Miniscan XE spectrophotometer, using the CIE L*a*b* system, where a value of L* describes lightness (L* = 0 for black, L* = 100 for white), a* describes colour intensity in red (a* > 0) or in green (a* < 0), b* describes colour intensity in yellow (b* > 0) or in blue (b* < 0). The measurements of colour were taken from 8-mm diameter fragments of flesh surface, and the instrument setup was: Illuminant = D65, Observer = 100.

Sensory evaluation was performed in sensory laboratory of the Department of Vegetable and Medicinal Plants. The trained panel consisting of 10 persons, previously selected and trained according to ISO standard (Anonymous, 1996a), carried out the sensory analysis. The assessment was carried out in a laboratory equipped according to ISO standard (Anonymous, 1998). At the first part of QDA procedure 'brainstorming' sessions were run to select sensory attributes for eggplant fruits. Panelists received samples of fruits varying in sensory properties and individually generated a set of 15 descriptors for odour, colour, texture and flavour. Also overall quality of fruits was scored (Table 1). For the evaluation of fruits the quantitative descriptive analysis (QDA) was used. Every assessor was given randomized samples of fruits. The analysis was performed in separate booths, equipped with computers for data acquisition. For the assessments whole fruits were boiled in water for 20 minutes at the temperature and then cooled to the ambient temperature. Samples of the fruits (slices of thick-

Table 1 Definitions of sensory descriptors used in the sensory quantitative descriptive analysis of pumpkin cultivars

No.	Descriptor	Definition	Anchoring points
		Odour	
1	Overall odour intensity	All odour intensity impression	Not detectable – very intensive
2	Odour of cooked vegetables	Characteristic odour of boiled vegetables	Not detectable – very intensive
3	Odour of cooked potatoes	Characteristic odour of boiled potatoes	Not detectable – very intensive
4	Different odour	Unusual odour for pumpkin	Not detectable – very intensive
	Appearance		
5	Flesh colour	Visual evaluation of flesh colour	Light – dark orange
		Texture	
6	Flesh firmness	Degree of force needed to chew the flesh	Firm - tender
7	Flesh structure	Evaluation of flesh structure	Homogenous - fibrous
8	Flesh consistency	Evaluation of flesh consistency	Very watery – very mealy
		Flavour / taste	
9	Taste of cooked pumpkin	Characteristic taste of cooked pumpkin	Not detectable – very intensive
10	Taste of cooked carrots	Characteristic taste of cooked carrots	Not detectable – very intensive
11	Sweet taste	Basic taste	Not detectable – very intensive
12	Insipid taste	Bland, insipid taste	Not detectable – very intensive
13	Sour taste	Basic taste	Not detectable – very intensive
14	Bitter taste	Basic taste	Not detectable – very intensive
15	Different flavour	Unusual flavour for pumpkin	Not detectable – very intensive
	Overall quality	General sensory quality impression	Low – high quality

ness 1 cm) were put to coded plastic boxes, covered with lids, and then served to the assessors. The assessments were marked on non-structural lines, on the monitors. These lines showed also the anchoring points for each descriptor (low intensity – high intensity). Results were converted to numerical values (from 0 to 10 units). The analysis was performed during two independent sessions, in two replications. For coding samples and for initial processing of the data Analsens software was used.

Chemical analyses and colour measurements were done on representative samples taken in three replicates from fresh plant material. Results of the experiment were statistically evaluated with ANOVA (Statgraphics Plus software), using singe-factor variance analysis. Tukey's HSD test was used to show which values differ significantly at P = 0.05. For the interpretation of of the results of sensory profiles assessment the Principal Component Analysis (PCA) was used.

Results and discussion

As it is stated in literature, the most important technological indices of pumpkin fruits are dry matter, soluble solids content and carotenoids content (Danilcenko et al., 2007). All these quality traits account also for sensory quality of the fruits. Results of the study, which is a continuation of our previous studies (Sztangret et al., 2004; Gajc-Wolska et al., 2005; Seroczyńska et al., 2006) showed that pumpkin cultivars differed greatly in respect of physical, chemical and sensory traits.

Colour coordinates in CIE Lab system are related to pigments content in the fruits, carotenoids especially. The lowest value of L* (lightness) and highest value of a* (redness) showed fruits of 'Bambino' cultivar (Tabel 2). The highest value of b* parameter showed fruits of 'Kroshka'. These cultivars were at the same time the ones of the highest soluble solids content in fruits, and 'Kroshka' was the cultivar of the highest beta-carotene and total carotenoids content. It was also the cultivar of the highest antioxidant activity of the fruits, measured by DPPH method. Concerning nitrates accumulation in fruits, 'Bambino' showed the lowest accumulation of these compounds, and 'Lecebnaja' and 'Miranda' cultivars – the highest. From nutritional point of view, a low tendency to nitrates accumulation is a positive trait of a vegetable crop.

High soluble solids content corresponds with high sugars content and is an important quality factor for sensory impression (Gajc-Wolska et al., 2005). The content of soluble solids in fruits varied greatly (Table 2). The highest contest showed fruits of 'Kroshka' and 'Bambino', and the lowest – 'Zolushka' and ' Lecebnaja'.

According to Murkovic et al., (2002) and Gajc-Wolska et al., (2005) the genotype significantly influences carotenoids content in pumpkin fruits. In this work, cvs. 'Kroshka', 'Zemcuzina' and 'Bambino' had the highest both total carotenoids and beta-carotene content in the fruits (Table 2).

Antioxidant activity of vegetables is very important quality trait from nutritional point of view. Paulauskiene et al. (2006) reported that the highest activity showed fruits of 'Justynka, but 'Kroshka', 'Ambar' and 'Amazonka'

Table 2 Quality parameters of pumpkin cultivars

Cultivar	Quality parameters of pumpkin							
	L	a	b	oBrix	NO3 (mg/kg)	Carotenoids (mg/100 g)	Beta-carotene (mg/100 g)	Anioxidant activity (% DPPH)
Kustovaja	76.1c	7.7a	32.3a	4.5c	243c	0.76a	0.58a	13.6a
Kroshka	65.9b	30.5c	71.6d	8.7f	74b	7.50e	6.59d	73.2c
Zemcuzina	65.7b	27.4c	61.3c	6.6d	245c	6.45d	5.30c	63.1b
Bambino	57.3a	37.4d	60.6c	7.9d	18a	5.40c	4.50b	56.7b
Miranda	72.8c	12.6b	48.9b	3.7bc	412d	0.90a	0.75a	10.4a
Zolushka	78.7c	3.9a	28.1a	3.0a	86b	0.45a	0.30a	9.5a
Lecebnaja	71.5bc	10.7ab	51.2c	3.3ab	520e	0.80a	0.73a	10.2a

Note: means in columns followed by the same letters not significantly differs at P≤0.05, according to Tukey's test

showed also very high activity. We found that 'Kroshka', 'Zemcuzina' and 'Bambino' were the cultivars of the highest antioxidant activity, and 'Zolushka', 'Miranda' and 'Lecebnaja' – the lowest.

Sensory quality characteristics is an important trait of vegetables for a consumer. The set of sensory attributes used in the QDA procedure was similar to the ones used in Gajc-Wolska et al., (2005) study. Sensory quality of pumpkins was determined after cooking process, as it is usual way in preparing pumpkins to the consumption. Fruits of investigated cultivars of pumpkins showed differentiated sensory characteristics. The highest overall odour intensity was found for 'Bambino' and 'Zolushka' fruits (Table 3). 'Bambino' fruits showed at the same time the highest intensity of odour of cooked vegetables, and 'Zolushka' fruits – of odour of cooked potatoes, together with 'Kroshka'. Different odour was determined on a low level (below 1 point of the scale). The most intensive colour of flesh was found in fruits of 'Bambino', and the least intensive - in fruits of 'Kustovaja' and 'Zolushka' cultivars v3). The least firm flesh was characteristic to fruits of cultivar 'Kustovaja', and the most firm – of cultivar 'Lecebnaja'. Flesh structure of the fruits was less differentiated, and the highest notes for flesh structure got fruits of cv. 'Lecebnaja'. Cultivars differed greatly in respect of flesh consistency of fruits. The highest scores got fruits of 'Kroshka' and 'Bambino' cultivars. In Gajc-Wolska et al., (2005) report, quite high relationship between CIE L*a*b* colour parameter b* (i.e. yellowness) and scores for visual evaluation of flesh colour was found. In this work scores for visual colour intensity were the highest for 'Bambino', which was the cultivar of the highest a* value (redness), and the lowest for 'Kustovaja' and 'Zolushka', the cultivars of the lowest a* value of fruits. The relationship in the case of b* parameter was not so evident.

Taste attributes of pumpkins involved both three basic tastes, i.e. sweet, sour and bitter, and also some specific tastes, which were detected during 'brainstorming session'. The highest impression of taste 'characteristic to cooked pumpkin' was noted for 'Bambino' and 'Kroshka' fruits, and of 'taste of cooked carrots' – for 'Zemcuzina' and 'Bambino'. Sweet taste was scored as the most intensive for 'Zemcuzina', 'Kroshka' and 'Bambino'. Insipid, 'soapy' taste is usually not preferred in food, and the lowest level of this attribute was found for 'Kroshka' and 'Zemcuzina' fruits. Sour taste and bitter taste were detected on a low level (below 1 point of scale used), and the same can be said also in the case of different flavour attribute. Overall quality impression, which takes into account all previously scored attributes, was the highest for 'Zemcuzina' fruits,

Table 3 Results of sensory analysis of pumpkin cultivars – odour, appearance and texture attributes (scale 0-10)

Cultivar	Odour, appearance and texture attributes							
	Overall odour intensity	Odour of cooked vegetables	Odour of cooked potatoes	Different odour	Flesh colour	Flesh firmness	Flesh structure	Flesh consistency
Kustovaja	5.14a	3.47a	3.73a	0.00a	0.54a	3.76a	4.70bc	2.93a
Kroshka	6.22b	4.01b	6.07d	0.13a	5.54b	7.79c	3.27a	8.78c
Zemcuzina	6.02b	4.73b	3.43a	0.53ab	6.25b	5.82b	4.51b	4.12ab
Bambino	6.92c	4.81b	5.45bc	1.07b	8.02c	7.50c	4.20b	7.54c
Miranda	6.35bc	3.65a	5.38bc	0.31a	5.95b	5.68b	5.25c	5.44b
Zolushka	6.42bc	3.27a	5.84cd	0.49ab	1.10a	8.13c	4.76bc	3.96a
Lecebnaja	5.43ab	2.96a	4.90b	0.42ab	3.33b	8.41c	4.54b	2.66a

Note: means in columns followed by the same letters not significantly differs at P≤0.05, according to Tukey's test

Tabel 4 Results of sensory analysis of pumpkin cultivars – taste / flavour attributes and overall quality (scale 0-10)

Cultivar	Taste / flavour attributes and overall quality							
	Taste of cooked pumpkin	Taste of cooked carrots	Sweet taste	Insipid taste	Sour taste	Bitter taste	Different flavour	Overall quality
Kustovaja	3.52a	1.35a	1.83a	3.32b	0.41a	0.32b	0.00a	3.89a
Kroshka	5.13c	2.99bc	4.13c	1.58a	0.40a	0.04a	1.00b	5.74b
Zemcuzina	5.76c	3.73c	5.47d	1.57a	0.32a	0.11a	0.25a	6.92c
Bambino	5.86c	3.58c	4.04c	2.02b	0.33a	0.05a	0.39a	5.75b
Miranda	4.92bc	2.34b	2.85b	3.50b	0.46a	0.30b	0.00a	5.25b
Zolushka	4.28b	2.13b	2.06a	3.70b	0.63a	0.37b	0.61ab	4.41a
Lecebnaja	4.00ab	2.03b	2.79b	3.89b	0.36a	0.60c	0.00a	4.18a

Note: means in columns followed by the same letters not significantly differs at P≤0.05, according to Tukey's test

and a little lower for 'Kroshka', 'Bambino' and 'Miranda' fruits.

In order to find the influence of sensory quality attributes on quality characteristics of cultivars, the principal component analysis (PCA) was performed. This kind of sensory data analysis is usually used for more detailed characteristics (Chabanet, 2000). PCA projection for sensory descriptors and cultivars are presented on Figure 1. PCA shows that two principal components (PC 1 and PC 2) explain together 76% of the variation between samples, with the first component alone accounting for 56% of the variation. The relationship between sensory attributes and fruit samples can be determined by their location on the projection. Big differentiation among samples is evident, since all points are situated in different locations on the projection. Points C and D are close to the vector of overall quality (vector 16), what indicates high quality of these samples, compared with the others. Vector of overall quality has opposite direction compared with vectors of insipid taste and bitter taste, so the influence of these quality traits on the overall quality impression is negative. This kind of relationship between sensory attributes was quite similar to that reported by Gajc-Wolska et al., (2005) for other cultivars of pumpkin.

To describe the relationship between scores for overall sensory quality and for all sensory descriptors, a linear multiple regression model was applied. In this model the assumption was done that the relationship is of a linear character. It is a simplification however, since there are reports on nonlinear relationship between the intensity of some sensory attributes and overall sensory quality (Meilgaard et al., 1999). The R2 statistics indicates that the model explains 66.3% of the variability of overall quality

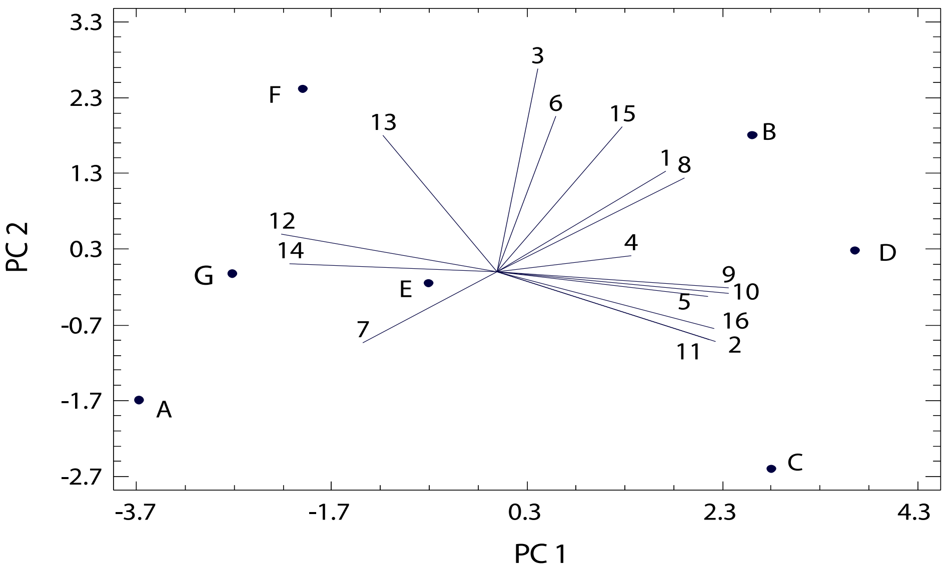

Figure 1 PCA projection for sensory quality of pumpkin cultivars. PC 1 – principal component 1 (56%), PC 2 – principal component 2 (20%). Vectors: 1 - overall odour intensity; 2 - odour of cooked vegetables; 3 - odour of cooked potatoes; 4 - different odour; 5 - flesh colour; 6 - flesh firmness; 7 - flesh structure; 8 - flesh consistency; 9 - taste of cooked pumpkin; 10 - taste of cooked carrots; 11 - sweet taste; 12 - insipid taste; 13 - acid taste; 14 - bitter taste; 15 - different flavour, 16 – overall quality. Cultivars: A - Kustovaja; B - Kroshka; C – Zemcuzina; D – Bambino; E - Miranda; F – Zolushka; G – Lecebnaja

Table 5 Correlation coefficients between chose quality parameters

Parameter	a*	b*	oBrix	Carote-noids	Beta-carotene	Anioxidant activity	Sweet taste	Overall quality
a*	x	0.87**	0.94**	0.91**	0.92**	0.92**	0.79	0.83*
b*	0.87**	x	0.81*	0.85*	0.88**	0.84*	0.75	0.84*
oBrix	0.94**	0.81*	x	0.95**	0.96**	0.96**	0.96**	0.96**
Carotenoids	0.91**	0.85*	0.95**	x	0.99**	0.99**	0.99**	0.99**
Beta-carotene	0.92**	0.88**	0.96**	0.99**	x	0.99**	0.99**	0.99**
Antioxidant activity	0.92**	0.84*	0.96**	0.99**	0.99**	x	0.82*	0.82*
Sweet taste	0.79	0.75	0.69	0.84**	0.82*	0.82*	x	0.96**
Overall quality	0.83*	0.84*	0.74	0.88**	0.88*	0.87*	0.96**	x

Note: * means correlation significant at P≤0.05, ** means correlation significant at P≤0.01

(the relationship is significant at $P \leq 0.01$). The equation of the fitted model is as follows:

$$Y_o = 3.65 - 0.06 x_1 + 0.18 x_2 + 0.15 x_3 - 0.09 x_4 + 0.10 x_5 - 0.06 x_6 - 0.09 x_7 - 0.09 x_8 + 0.44 x_9 - 0.08 x_{10} + 0.12 x_{11} - 0.28 x_{12} - 0.54 x_{13} + 0.10 x_{14} - 0.12 x_{15}$$

In this equation: Y_o – score expected for overall quality of pumpkin; x_1 - x_{15} – independent variables, expressed by scores obtained for sensory attributes of fruits and numbered according to Table 1.

Overall quality and all attributes are expressed in numerical values from 0 to 10 units.

Figure 2 illustrates the relationship between experimental and predicted scores for overall quality of pumpkin, based on the model described above. The most important attributes in this equation (i.e. of the lowest P-value) are 'taste of cooked pumpkin', insipid taste and sour taste.

Correlations between some quality parameters of pumpkin fruits are shown in Table 6. Strong and significant relationship was found between colour parameters (a* and b*) and beta-carotene and total carotenoids content. Correlation between colour parameters in CIE Lab system and carotenoids content in vegetables were found also in some other works (Park et al., 1995, Seroczyńska et al., 2006). Fruits of high a* value showed also high soluble solids content (oBrix). Strong correlation was also found for antioxidant activity and beta-carotene or total carotenoids content in fruits. It confirms literature data that carotenoids ate strong antioxidants (Palace et al. 1999). Also in other study strong correlation was found between carotenoids content and antioxidative activity of pumpkin fruit flesh of some cultivars (r = 0.91) (Paulauskiene et al. (2006).

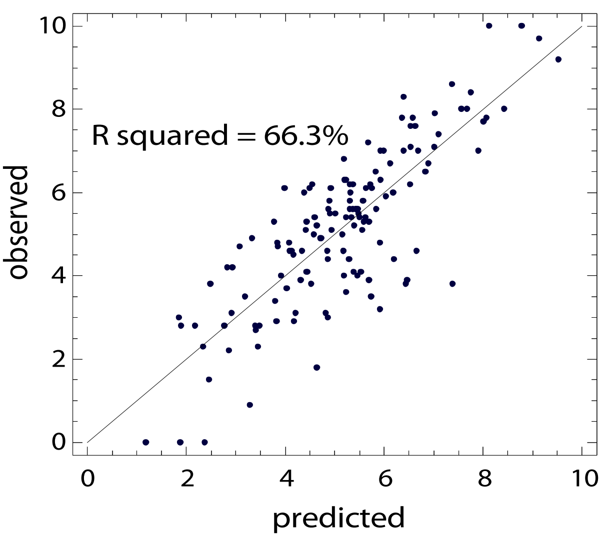

Figure 2 Relationship between observed and predicted overall sensory quality scores for pumpkin cultivars, according to the regression model presented (details - see text)

Sweet taste impression usually results from sugars occurence in food. In order to find the relationship between sugars content and sweet taste impression, correlation coefficient was calculated. Sweet taste intensity and overall quality correlated strongly with soluble solids content in pumpkin fruts, but also with carotenoids content (Table 6). Also strong relationship between overall quality and sweet taste intensity was proved. It confirms opinion (Corrigan et al., 2000) that pumpkin fruits of high sugars and carotenoids content are regarded as the better quality products.

Conclusions

Chosen pumpkin cultivars differed both in chemical composition of fruits, their colour and sensory characteristics. The cultivars of the highest content of soluble solids were 'Kroshka' and 'Bambino'. 'Kroshka' was the cultivar of the highest carotenoids content and antioxidant acivity. Overall sensory quality was the highest for 'Zemcuzina' cultivar. Taken into account nutritional parameters determined and sensory traits, the most valuable cultivars were 'Bambino', 'Kroshka' and 'Zemcuzina'. Significant relationship between carotenoids content and antioxidant activity of pumpkin fruits exists. Overall sensory impression can be predicted with high probability level using the multiple regression model.

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