

Great Pumpkins and Blue Fleshed Potatoes – Biologically Active Raw Material for Food Products



Agriculture

KEYWORDS : Great pumpkin, blue fleshed potato, chemical content, quality

| | |
|-----------------------------|------------------------------------------------------------------------------------------------------|
| Danilčenko Honorata | Aleksandras Stulginskis University, Studentų str. 11, Akademija, LT-53361 Kauno district, Lithuania. |
| Jarienė Elvyra | Aleksandras Stulginskis University, Studentų str. 11, Akademija, LT-53361 Kauno district, Lithuania. |
| Vaitkevičienė Nijolė | Aleksandras Stulginskis University, Studentų str. 11, Akademija, LT-53361 Kauno district, Lithuania. |
| Juknevičienė Edita | Aleksandras Stulginskis University, Studentų str. 11, Akademija, LT-53361 Kauno district, Lithuania. |
| Gajewski Marek | Warsaw University of Life Sciences, Nowoursynowska159, 02-776 Warsaw, Poland. |

ABSTRACT

Modern consumers are more concerned about the safety and quality of food they consume. In this way changes are inevitable in the cultivation of raw materials, their processing and marketing. The main aim of this study was to investigate and to compare the quality of the great pumpkin's 'Justynka F1', 'Karowita' fruit flesh and the blue fleshed potato's 'Blue Congo', 'Vitelotte' tubers. Standard methods were applied to identify the following: dry matter, crude protein, crude fibre and crude ash. It was performed a comparative analysis of the results. Research results showed that the highest quantity of the dry matter have been found in potato cv. 'Vitelotte' (23.7 %). The flesh of cv. 'Karowita' is valuable due high crude protein (11.90 % d. m.) and crude fibre (6.38 % d. m.) content. The fruit flesh of cv. 'Justynka F1' is rich in crude ash – 8.89 % d. m.

INTRODUCTION

The vegetables has got very important role in human nutrition and their health benefit is undoubted (Rop et al., 2010). Therefore, recently more and more attention is being given to the research of non-traditional vegetables which accumulate bigger amounts of high quality nutrients. Great pumpkins (*Cucurbita maxima* D.) and blue fleshed potatoes (*Solanum tuberosum* L.) are alternative, not widely spread vegetables, containing components important for humans.

Blue fleshed potatoes are gaining popularity due to the potential health benefits of anthocyanins (Nayak et al., 2011). These compounds are known as phytochemicals possessing high free-radical scavenging activity acting in reducing the risk of chronic diseases and age-related neuronal degeneration (Teow et al., 2007). Their other quality parameters are not too different from traditional potato varieties. About 20 to 30 percent of potato is dry matter with a high percentage of starch. Other considerable portions of dry matter consist of sugar and dietary fibre. Potatoes are rich in a number of organic micronutrients and contain appreciable levels of minerals. Potato is a valuable energy food containing well digested carbohydrates and simultaneously in the range of 10 g 100 g⁻¹ DW protein which is one of the best plant proteins as a source of lysine. Due to its high content, potato proteins can be a good supplement of cereal products, limited by this amino acid. High nutritional quality of potato protein indicates amino acid composition and digestibility related to casein which is recognized as the best digest protein (Friedman, 1996; Bergthaller et al., 1999; Lutaladio et al., 2009).

Studies on nutritive value of pumpkins showed that they have a lot of biologically active compounds – vitamin C, vitamin E, minerals, pectins, carotenoids. This vegetable has become a valuable part of slimming diets, a constituent that controls metabolism, as well as exerts a detoxifying and dehydrating effect (Oszmiański & Górska, 2002). The fruits of pumpkins also are good sources of proteins and fibre. Proteins are irreplaceable, because other nutrients don't have nitrogen or amino acids. Many investigations have been reported concerning the health benefits or the quantities of the fibre found in fruits and vegetables (Jenkins et al., 1998; Nawirska & Kwaśniewska, 2005). Most of the research has concentrated on the physiological properties of fibre and how they influence the gastrointestinal tract. The fibre plays an important role in the prevention and

cure of diabetes, obesity, atherosclerosis, heart diseases, colon cancer and colorectal cancer (Ferguson & Harris, 2003).

Minerals also play an important role for the human body. They help to absorb vitamins; are an integral part of bones, teeth, soft tissues, muscles, blood and nerve cells. Subramanian et al. (2010) discuss, that at last 22 mineral elements are required for the well-being of humans and these can be supplied by a balanced diet.

The main aim of this study was to investigate and to compare the quality of the great pumpkin's 'Justynka F₁', 'Karowita' fruit flesh and the blue fleshed potato's 'Blue Congo', 'Vitelotte' tubers.

MATERIALS AND METHODS

The following great pumpkin and blue fleshed potato cultivars were selected for the investigations: *Cucurbita maxima* D. – 'Justynka F₁' and 'Karowita' grown in ecological farm in Kaunas district; *Solanum tuberosum* L. – 'Blue Congo' and 'Vitelotte', grown in ecological farm in Prienai district;

Great pumpkin's fruit flesh and potato tubers were analyzed in dry matter for: dry matter (ISO 751:2000); crude protein (LST 1523:1998); crude fibre and crude ash (Methodenbuch-VDLU-FA, 1983-1999).

Chemical pumpkin's and potato tuber's analysis were conducted at the Aleksandras Stulginskis University in the chemistry laboratories of Food raw materials, agronomical and zoo-technical investigations; laboratory of food technologies, Institute of Agriculture and Food Sciences.

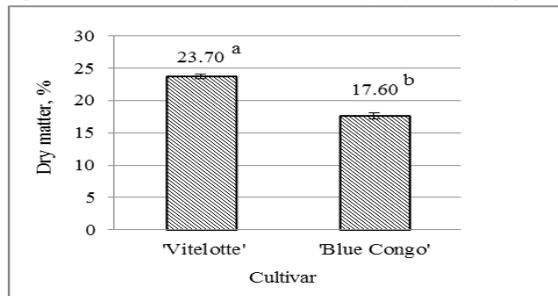
Statistical analysis was performed using One Way ANOVA (STATISTICA software). Statistical significance was considered at p<0.05. Arithmetic means and standard deviations of research data were calculated with EXCEL program. Vertical bars graphed in figures indicated standard deviation.

RESULTS AND DISCUSSION

One of the most important chemical content quality indicators is the amount of dry matter. This indicator ensures the quality and output of the recycled products. Great pumpkins that are grown in Lithuania can accumulate 7.41–22.20 % of dry mat-

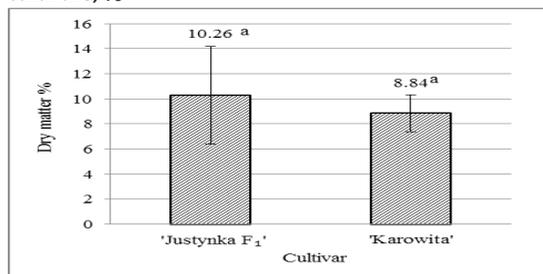
ter (Konopacka et al., 2010; Nawirska-Olszańska et al., 2011). Depending on the cultivar, the amounts of dry matter in potato tubers can fluctuate from 13.1 to 36.8% (Hassanpanah et al., 2011).

Our results showed that dry matter content of both plants depended on the cultivar. Considerably higher quantity of the above mentioned substances have been found in potato tubers. The amount of dry matter in cv. 'Vitelotte' was found significantly higher than in 'Blue Congo' potato tubers – the difference has reached 26% (Figure 1). Dry matter in pumpkin flesh was similar, significant differences were not identified, and it was equal to 8.84% 'Karowita' and 10.26% 'Justynka F1' (Figure 2).



The same letters show no significant differences between means ($p < 0.05$)

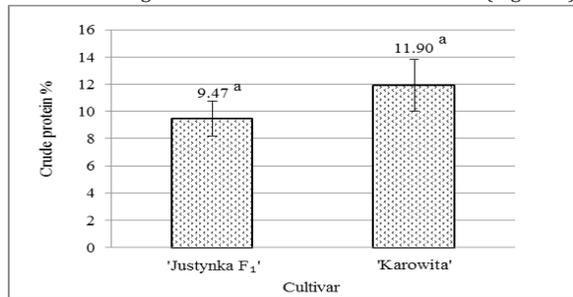
Figure 1. Dry matter content in the blue fleshed potatoes cultivars, %



The same letters show no significant differences between means ($p < 0.05$)

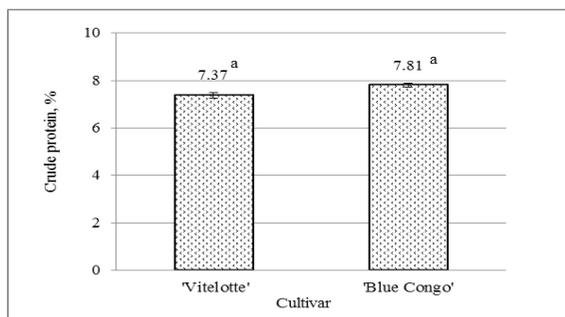
Figure 2. Dry matter content in the great pumpkin cultivars, %

In the human body, protein plays an important role in the biochemical, biophysical and physiological processes. Protein is required for all most all functions of the body as well as the structural integrity of the cells. After the research it was found that 'Karowita' flesh accumulated the highest amount of crude protein – 11.90% d. m. (Figure 3). The amount of these substances was similar between pumpkin cultivars. Crude protein content in both genotypes of potato tubers was similar, significant differences were not identified, and it was equal to 7.81% d. m. 'Blue Congo' and 7.37% d. m. 'Vitelotte' tubers (Figure 4).



The same letters show no significant differences between means ($p < 0.05$)

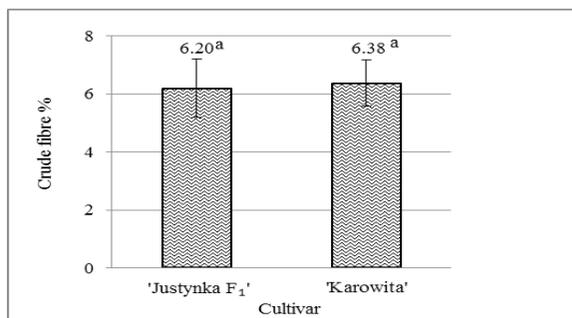
Figure 3. Crude protein content in the great pumpkin cultivars, %



The same letters show no significant differences between means ($p < 0.05$)

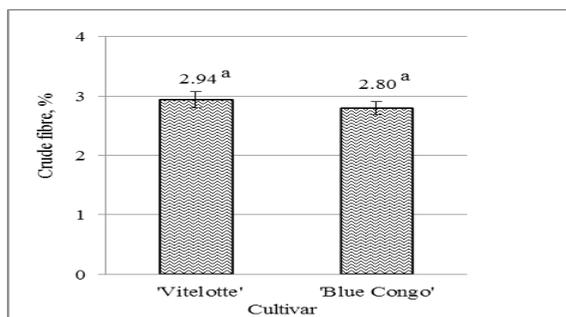
Figure 4. Crude protein content in the blue fleshed potatoes cultivars, %

Fibre is an important component of a healthy balanced diet. The global organizations like FAO and WHO recommended intake ≥ 400 g/d of vegetables, i.e. > 25 g/d of total dietary fibre (Nishida et al., 2004). Many people do not reach this daily amount. Lack of fibre has been linked to increased risk of bowel cancer and other chronic diseases such as heart disease and diabetes. Less fibre in the diet also increases the likelihood of constipation, haemorrhoids and possibly diverticular disease. It was identified, that on the average, most of the crude fibre in dry matter was accumulated in 'Karowita' flesh (6.38%) (Figure 5). Cv. 'Blue Congo' accumulated the lowest amount of crude fibre – 2.80% (Figure 6). Quantity of crude fibre didn't differ significantly between pumpkin cultivars. Also no significant differences have been found in both genotypes of potato tubers.



The same letters show no significant differences between means ($p < 0.05$)

Figure 5. Crude fibre content in the great pumpkin cultivars, %

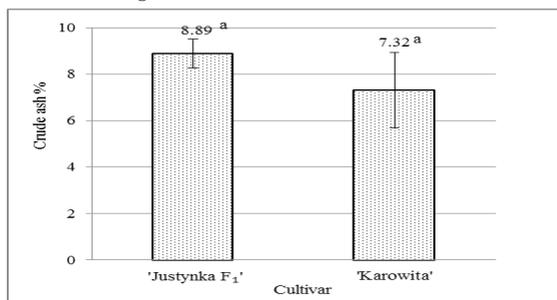


The same letters show no significant differences between means ($p < 0.05$)

Figure 6. Crude fibre content in the blue fleshed potatoes cultivars, %

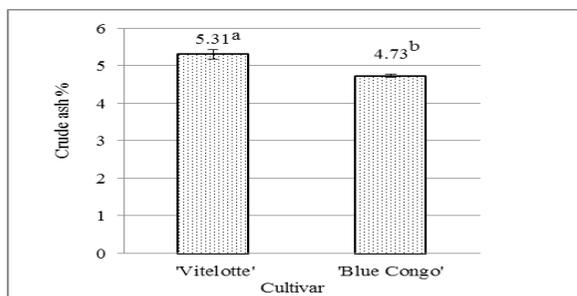
Quantities of minerals in vegetables are influenced by numerous complex factors including genotype, soil, environmental conditions and nutrition interactions. Minerals are elements required for human body for the most important several purposes like formation of blood, bones and teeth even other tissues, osmoregulation of body fluids, control of physico-chemical pro-

cess. Their deficiency in the human body creates different types of problems and diseases. It was found that the highest amount of crude ash was accumulated in the fruit flesh of cv. 'Justynka F₁' – 8.89 % d. m. (Figure 7). The flesh of potato cv. 'Blue Congo' accumulated the significantly lowest amount of crude ash – it is 1.1 times lower amount it compared with flesh of cv. 'Vitelotte' (Figure 8). Quantity of crude ash was similar between pumpkin cultivars, no significant differences have been found.



The same letters show no significant differences between means (p<0.05)

Figure 7. Crude ash content in the great pumpkin cultivars, %



The same letters show no significant differences between means (p<0.05)

Figure 8. Crude ash content in the blue fleshed potatoes cultivars, %

CONCLUSION

Having summarized the research results it can be claimed that the highest quantity of the dry matter have been found in potato cv. 'Vitelotte' (23.7 %). The flesh of cv. 'Karowita' is valuable due high crude protein (11.90 % d. m.) and crude fibre (6.38 % d. m.) content. The fruit flesh of cv. 'Justynka F₁' is rich in crude ash – 8.89 % d. m. For effective and nutritionally appropriate food processing we recommend blue fleshed potato cv. 'Vitelotte' and the pumpkin cvs. 'Karowita' and 'Justynka F₁'.

DEDICATION

This research was funded by a grant for PhD students (registration number of application – DOK-13549) from the Research Council of Lithuania and by the project EUREKA E! 6855 EC-ORAW „Higher functionality food products from organic vegetable raw materials“.

REFERENCE

- Berghaller, W., Witt, W., & Goldau, H. P. (1999). Potato starch technology. *Starch / Stärke* 51, pp. 235-242. | 2. Ferguson, L. R., & Harris, P. J. (2003). The dietary fibre debate: more food for thought. *The Lancet* 361, pp. 1487-1488. | 3. Friedman, M. (1996). Nutritional Value of Proteins from Different Food Sources. A review. *Journal of Agriculture and Food Chemistry* 44 (1), pp. 6-29. | 4. Hassanpanah, D., Hassanabadi, H., & Azizi Chakherchaman, S.H., (2011) Evaluation of Cooking Quality Characteristics of Advanced Clones and Potato Cultivars. *American Journal of Food Technology*, 6, pp. 72-79. | 5. Jenkins, D. J. A., Kendall, C. W. C., & Ransom, T. P. P. (1998). Dietary fibre, the evolution of the human diet and coronary heart disease. *Nutrition Research*, 18 (4), pp. 633-652. | 6. Konopacka, D., Seroczyńska, A., Korzeniewska, A., Jesionkowska, K., Niemirowicz-Szczytt, K., & Plocharski, W. (2010). Studies on the usefulness of Cucurbita maxima for the production of ready-to-eat dried vegetable snacks with a high carotenoid content. *Food Science and Technology*, 43 (2), pp. 302-309. | 7. LST 1523:1998. Cereal, cereal products and animal stuffs. Determination of nitrogen by the Kjeldahl method and calculation of crude protein. | 8. LST ISO 751:2000. Fruit and vegetable products. Determination of water-insoluble solids (idt ISO 751:1998 [E]). | 9. Luta-ladio, N. & Castaldi, L. (2009). Potato: The hidden treasure. *Journal of Food Composition and Analysis*, 22(6), pp. 491-493. | 10. Methodenbuch – VDLUFA. 1983-1999. Band III. Die chemische Untersuchung von Futtermitteln. – Verlag-Darmstadt. | 11. Nayak, B., Berrios, J. J., Powers, J. R., Tang, J., & Ji, Y. (2011). Colored potatoes (*Solanum tuberosum* L.) dried for antioxidant-rich value-added foods. *Journal of Food Processing and Preservation*, 35, pp. 571-580. | 12. Nawirska, A., & Kwaśniewska, M. (2005). Dietary fibre fractions from fruit and vegetable processing waste. *Food Chemistry*, 91, pp. 221-225. | 13. Nawirska-Olszańska, A. (2011). Przydatność owoców dyni jako surowca do przetwórstwa spożywczego. Monografie CXXXII. Wrocław, pp. 59. | 14. Nishida, C., Uauy, R., Kumanyika, S., Shetty, P. (2004). The Joint WHO/FAO Expert Consultation on diet, nutrition and the prevention of chronic diseases: process, product and policy implications. *Public Health Nutrition*, 7(1A), pp. 245-250. | 15. Oszmiański, J., & Górski, M. (2002). Improvement of carotenoid content and colour in carrot juice concentrate. *Fruit Proc.*, 2, pp. 70-73. | 16. Rop, O., Řezníček, V., Valšíková, M., Juríková, T., Mlček, J. & Kramárová, D. (2010). Antioxidant Properties of Cranberrybush Fruit (*Viburnum opulus* var. *edule*). *Molecules*, 15(6), pp. 4467-4477. | 17. Subramanian, K., Ramsay, G., White, C., Hackett, A. & Broadley, M. (2010). Exploiting Genetic Variation for Elevated Minerals Concentrations in Potatoes. *EUCARPIA*, Wageningen, pp. 89-92. | 18. Teow, Ch.C., Truong, V.D., McFeeters, R.F., Thompson, R.L., Pecota, K.V. & Yencho, G.C. (2007). Antioxidant activities, phenolic and β-carotene contents of sweet potato genotypes with varying flesh colours. *Food Chemistry* 103, pp. 829-83. |