

From the Research Laboratories
В изследователските лаборатории

NUTRIENT COMPOSITION OF *CUCURBITA MELO* GROWING IN KOSOVO

Fatmir Faiku, Arben Haziri, Fatbardh Gashi, Naser Troni
University of Pristina – Kosovo

Abstract. Pumpkins have considerable variation in nutrient contents depending on the cultivation environment, species, or part. Lipids, proteins, carbohydrates, moisture, ash and minerals, were quantitatively determined from the *Cucurbita melo* growing in Obiliq (a city in central Kosovo) and Peja (a city in western Kosovo). Total proteins were analyzed, by Kjeldahl method, in flesh, skin, and seeds in *Cucurbita melo* growing in Obiliq and Peja. The levels of total proteins (in Obiliq) in flesh, skin and seed are 0.80 %, 1.83 %, 13.7 %, respectively. The levels of total proteins (in Peja) in flesh, skin and seed are 0.60 %, 1.53 %, 12.7 %, respectively. Lipids are analyzed by Soxhlet extraction in flesh, skin, and seed. The mean levels of lipids (in Obiliq) in flesh, skin and seeds are 0.10 %, 0.30 %, 19.4 %, respectively. The levels of total proteins (in Peja) in flesh, skin and seeds are 0.10 %, 0.80 %, 14.0 %, respectively. The mean levels of carbohydrates (in Obiliq) in flesh, skin and seeds are 20.1 %, 12.8 %, 6.90 %, respectively. The levels of total carbohydrates (in Peja) in flesh, skin and seeds are 17.0 %, 16.10 %, 18.3 %, respectively. The mineral content was studied and analyzed by flame atomic absorption spectrometry. Seven elements, iron, copper, zinc, magnesium, calcium, sodium and potassium were determined in *Cucurbita melo*. From our investigation we can conclude that *Cucurbita melo* growing in Obiliq, contains more potassium than other elements. The potassium is more concentrated in skin than other parts of *Cucurbita melo*. *Cucurbita melo* growing in Peja, contains more calcium than other elements. The calcium is more concentrated in skin than other parts of *Cucurbita melo*.

Keywords: *Curcubita melo*, protein, mineral, carbohydrate, skin, seed, flesh

Introduction

Good nutrition is a basic human right. In order to have a healthy population that can promote development, the relation between food, nutrition and health should be reinforced. In developing countries, one of the ways of achieving this is through the exploitation of available local resources, in order to satisfy the needs of the increasing population (Achu et al., 2005).

Pumpkins are gourd squashes of the genus *Cucurbita* and the family *Cucurbitaceae* (Kim et al., 2012; Phillips et al., 2005).

Pumpkins have been used for a long time in traditional medicine in many countries, such as China, Argentina, India, Mexico, Brazil, and Korea, since pumpkin flesh and seeds are rich not only in proteins, antioxidant vitamins, such as carotenoids and tocopherols (Stevenson et al., 2007) and minerals, but low in fat and calories.

Pumpkin seeds, often eaten as a snack, are a good source of zinc, polyunsaturated fatty acids (Glew et al., 2006; Sabudak, 2006) and phytosterols (e.g., β -sitosterol), (Phillips et al., 2005; Ryan et al., 2007), which can prevent chronic diseases. Recent studies have reported that pumpkin can benefit the treatment of benign prostate hyperplasia, because of its high β -sitosterol content (Carbin et al., 1990; Dvorkin & Song, 2002). β -Sitosterol has been indicated to reduce blood cholesterol and to decrease risks of certain types of cancers.

Zoro Bi et al. (2006) reported a review of the inter- and interspecies diversity of *Cucurbit* species consumed in sauce in Ivory Coast. The flesh of their fruits is light green and has bitter taste. Some reports available on the composition of seeds and seed kernels of *cucurbits* indicated that they are rich in macronutrients: lipids, proteins and carbohydrates (Badifu, 1991; De Mello et al., 2000; Badifou, 2001; Loukou et al., 2007). The content of macronutrients varies between 20% and 50% depending on the species and the geographical regions.

Teotia & Ramakrishna (1984) reported that the seeds of melon grown in India contained from 40 to 47% of oils and from 23 to 36% of proteins.

Rashwan et al. (1993) showed that lipid and protein contents (on dry weight basis) for seed kernels of sweet melon varieties of *Cucurbita melo* were approximately 37% and 54%, respectively. In short, many studies on cucurbit varieties reported that they are an important oil source for human diet, a source of energy and carbon building blocks.

The aim of this research was to determine the quantity of lipids, proteins, carbohydrates, moisture, ash and minerals, were quantitatively determined from the *Cucurbita melo* growing in Obiliq and Peja.

Materials and methods

The samples of *Cucurbita melo*, growing in Obiliq (a city central Kosovo) and Peja (a city in western Kosovo), are taken in November 2014. The samples were divided into 3 parts: flesh, skin and seed. Samples were freeze-dried, mixed using a hand blender, and stored at -70 °C until analyzed. All samples in this study were analyzed in triplicate. Proteins were analyzed using the macro-Kjeldahl method using a Foss Kjeltac 2300 automatic analyzer.¹⁾ Ash was determined by a muffle furnace set at 550°C.¹⁾ Moisture content was determined using oven drying method at 105°C overnight.¹⁾ Total lipids were determined by continuous extraction in a Soxhlet apparatus using diethyl ether as solvent (Jensen, 2007). Minerals (iron, copper, zinc, magnesium, calcium, sodium and potassium) were analyzed by atomic absorption

spectrophotometry (Buc Scientific Model 200A)²⁾ following the method used by Idouraine et al., (1995) Total carbohydrate contents were calculated by $100 - (\text{g moisture} + \text{g protein} + \text{g fat} + \text{g ash})$.³⁾

Results and discussion

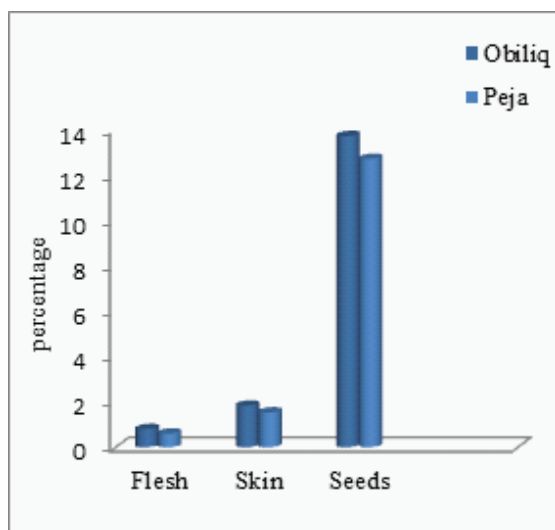
Cucurbita melo are analyzed in chemical aspect with the goal to research the chemical nature. The amount of lipids, proteins, carbohydrates, moisture, ash and minerals of *Cucurbita melo* growing in Obiliq is given in Table 1.

Table1. Chemical compositions of *Cucurbita melo* growing in Obiliq

Nutrients (%)	Part		
	Flesh	Skin	Seeds
Moisture	72.0	78.80	44.0
Ash	1.33	1.88	2.1
Lipids	0.10	0.30	19.4
Proteins	0.80	1.83	13.7
Carbohydrates	25.77	17.19	20.80

From experimental data (Table 1) we can see that the amounts of the levels of total proteins in flesh, skin and seeds are 0.80 %, 1.83 %, 13.7 %, respectively.

From Fig. 1 we can see that the higher amount of proteins (in Obiliq) is in seeds (13.7 %) and in other parts of the *Cucurbita melo* proteins amount is approximately the same. The mean levels of lipids (Table 1) in flesh, skin and seeds are 0.10



%, 0.30 %, 19.4 %, respectively. Figs. 1-3 show the diagrams for the proteins, lipids and carbohydrates to *Cucurbita melo* growing in Obiliq and Peja. From Fig. 2 we can see that the higher amount of lipids (in Obiliq) is in seeds (19.4 %) and in other parts of the *Cucurbita melo* lipids amount is approximately the same.

Figure 1. The diagram of the quantity of the proteins of the *Cucurbita melo*

The mean levels of ash (Table 1) in flesh, skin and seeds are 1.33 %, 1.88 %, 2.1 %, respectively. The amount of ash in flesh, skin and seeds almost is the same. From experimental data (Table 1) we can see that the amounts of the levels of total carbohydrates in flesh, skin and seeds are 25.77 %, 17.19 %, 20.8 %, respectively. From Fig. 3 we can see that the higher amount of carbohydrates (in Obiliq) is in flesh (25.77 %) and lower in skin (17.19 %). The mean levels of moisture (Table 1) in flesh, skin and seeds are 72.0 %, 78.80 %, 44.00 %, respectively. The higher amount of moisture is in skin (78.80 %) and lower in seeds (44.0 %).

The amount of lipids, proteins, carbohydrates, moisture, ash and minerals of *Cucurbita melo* growing in Peja is given in Table 2.

From experimental data (Table 2) we can see that the amounts of the levels of total proteins in flesh, skin and seeds are 0.60 %, 1.53 %, 12.7 %, respectively. From Fig. 1 we can see that the higher amount of proteins (in Peja) is in seeds (12.7 %) and in other parts of the *Cucurbita melo* proteins amount is approximately the same. The mean levels of lipids (Table 2) in flesh, skin and seeds are 0.10 %, 0.80 %, 14.0 %, respectively. From Fig. 2 we can see that the higher amount of lipids (in Peja) is in seeds (14.0 %) and in other parts of the *Cucurbita melo* lipids amount is approximately the same. From experimental data (Table 2) we can see that the amounts of the levels of total carbohydrates in flesh, skin and seeds are 20.52 %, 22.49 %, 9.6 %, respectively. From Fig. 3 we can see that the higher amount of carbohydrates (in Peja) is in skin (22.49 %) and lower in seeds (9.60 %).

On Figs. 4 and 5 show the diagrams for the moisture and ash to *Cucurbita melo* growing in Obiliq and Peja.

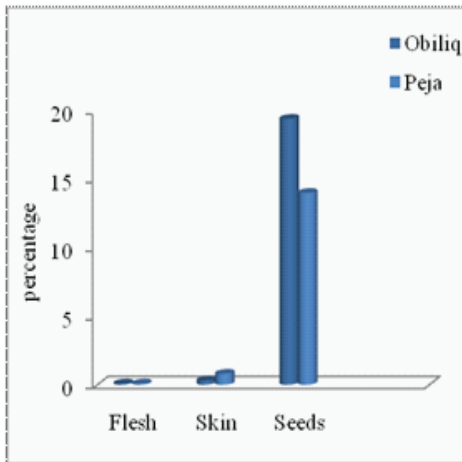


Figure 2. The diagram of the quantity of the lipids of the *Cucurbita melo*

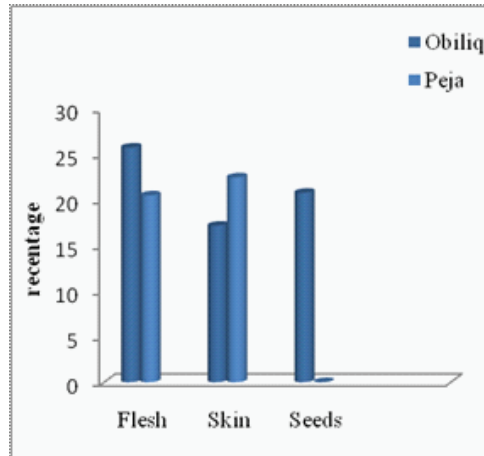


Figure3. The diagram of the quantity of the carbohydrates of the *Cucurbita melo*

The mean levels of moisture (Table 2) in flesh, skin and seeds are 77.92 %, 74.30 %, 45.40 %, respectively. From Fig. 4 we can see that the higher amount of moisture (in Peja) is in flesh (78.80 %) and lower in seeds (45.40 %). The mean levels of ash (Table 2) in flesh, skin and seeds are 0.86 %, 0.88 %, 18.3 %, respectively. From Fig. 5 we can see that the higher amount of ash (in Peja) is in seeds (18.3 %) and in other parts of the *Cucurbita melo* ash amount is approximately the same.

Table 2. Chemical compositions of *Cucurbita melo* growing in Peja

Nutrients (%)	Part		
	Flesh	Skin	Seeds
Moisture	77.92	74.30	45.40
Ash	0.86	0.88	18.3
Lipids	0.10	0.80	14.0
Proteins	0.60	1.53	12.7
Carbohydrates	20.52	22.49	9.60

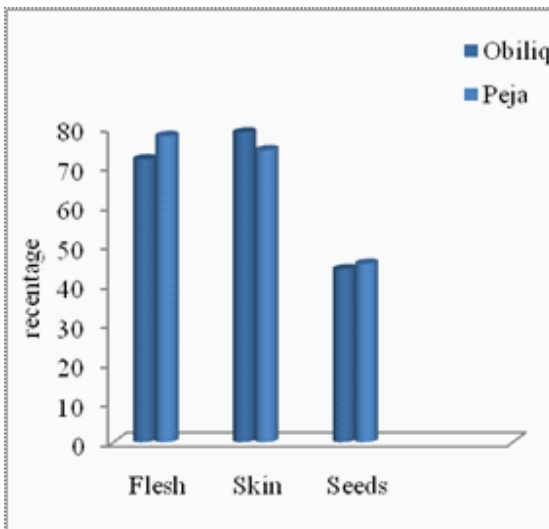


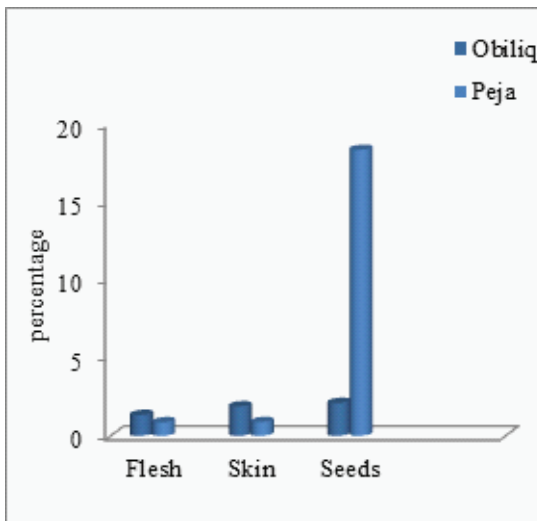
Figure 4. The diagram of the quantity of the moisture of the *Cucurbita melo*

The amount of proteins, lipids carbohydrates and moisture in *Cucurbita melo* growing in Obiliq is higher than the amount of proteins, lipids, carbohydrates and moisture in *Cucurbita melo* growing in Peja (Figs. 1-3). The amount of ash in *Cucurbita melo* growing in Peja is higher than the amount of ash in *Cucurbita melo* growing in Obiliq.

The amount of lipids in *Cucurbita melo* growing in Obiliq (19.4 %) and in Peja (14.00 %) in seeds is lower than the amount of lipids from Ghana (50 %) (Stainer-Asiedu et al.,2014). The amount of moisture in *Cucurbita melo* growing in Obiliq (44.0 %) and in Peja (12.7 %) in seeds is higher

than the amount of moisture from Ghana (6.34 %) (Stainer-Asiedu et al.,2014).

The amount of ash in *Cucurbita melo* growing in Obiliq (2.1 %) in seeds is lower than the amount of ash from Ghana (3.56 %) (Stainer-Asiedu et al.,2014). The amount of ash in *Cucurbita melo* growing in Peja (9.6 %) in seeds is higher than the



amount of ash from Ghana (3.56 %) (Stainer-Asieduet et al.,2014).

Also we did the research in the quantity of the minerals iron, copper, zinc, magnesium, calcium, sodium and potassium. The amount of minerals of *Cucurbita melo* growing in Obiliq are given in Table 3.

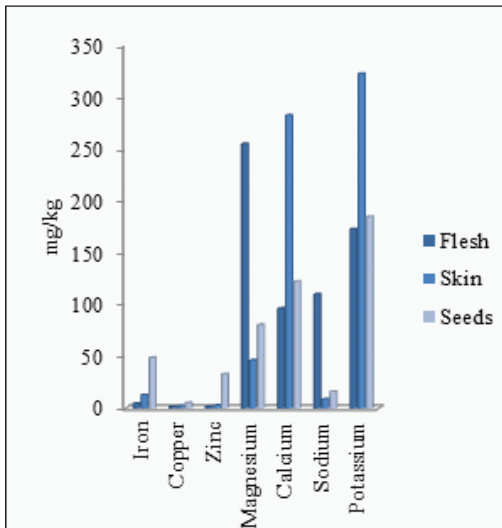
Figure 5. The diagram of the quantity of the ash of the *Cucurbita melo*

Table 3. Mineral content of *Cucurbita melo* growing in Obiliq

Mineral elements (mg kg ⁻¹)	Flesh	Skin	Seeds
Iron	4.70	12.87	48.84
Copper	1.45	2.23	5.28
Zinc	1.57	3.02	33.01
Magnesium	254.39	46.33	80.34
Calcium	96.22	281.76	122.1
Sodium	109.65	8.85	16.1
Potassium	172.31	321.75	184.17

From experimental data (Table 3) we can see that the mean of minerals iron, copper, zinc, magnesium, calcium, sodium and potassium are 4.70 mg kg⁻¹, 1.45 mg kg⁻¹, 1.57 mg kg⁻¹, 254.39 mg kg⁻¹, 96.22 mg kg⁻¹, 109.65 mg kg⁻¹, 172.31 mg kg⁻¹ in flesh of *Cucurbita melo* growing in Obiliq, respectively. The mean levels of minerals iron, copper, zinc, magnesium, calcium, sodium and potassium are 12.87 mg kg⁻¹, 2.23 mg kg⁻¹, 3.02 mg kg⁻¹, 46.33 mg kg⁻¹, 281.76 mg kg⁻¹, 8.85 mg kg⁻¹, 321.75 mg kg⁻¹ in skin of *Cucurbita melo* growing in Obiliq, respectively. The mean levels of minerals iron, copper, zinc, magnesium, calcium, sodium and potassium are 48.84 mg kg⁻¹, 5.28 mg kg⁻¹, 33.01 mg kg⁻¹, 80.34 mg kg⁻¹, 122.1 mg kg⁻¹, 16.1 mg kg⁻¹, 184.17 mg kg⁻¹ in seeds of *Cucurbita melo* growing in Obiliq, respectively. Fig. 6 shows the minerals quantity in the flesh, skin and seeds in *Curcubita melo* growing in Obiliq.

Fig. 6 shows that *Cucurbita melo* growing in Obiliq contains large amounts of potassium (321.75 mg kg⁻¹) and calcium (281.76 mg kg⁻¹) in the skin. Magnesium in large



quantities found in flesh (254.39 mg kg⁻¹). Also in the flesh, skin and seeds the amount of copper is low 1.45 mg kg⁻¹, 2.23 mg kg⁻¹, 5.28 mg kg⁻¹, respectively. The amount of sodium in all parts of *Curcubita melo* growing in Obiliq is almost same.

The amount of minerals of *Cucurbita melo* growing in Peja are given in Table 4.

Figure 6. Diagram of the quantity of elements in flesh, yskin and seeds of of *Cucurbita melo* growing in Obiliq

Table 4. Mineral content of *Cucurbita melo* growing in Peja

Mineral elements (mg kg ⁻¹)	Flesh	Skin	Seeds
Iron	3.49	12.00	36.62
Copper	1.96	1.85	4.88
Zinc	4.42	6.60	6.51
Magnesium	29.26	44.79	75.26
Calcium	153.61	350.97	253.44
Sodium	8.98	9.2	10.58
Potassium	123.56	53.32	110.68

From experimental data (Table 4) we can see that the mean of minerals iron, copper, zinc, magnesium, calcium, sodium and potassium are 3.49 mg kg⁻¹, 1.96 mg kg⁻¹, 4.42 mg kg⁻¹, 29.28 mg kg⁻¹, 153.61 mg kg⁻¹, 8.98 mg kg⁻¹, 123.56 mg kg⁻¹ in flesh of *Cucurbita melo* growing in Peja, respectively. The mean levels of minerals iron, copper, zinc, magnesium, calcium, sodium and potassium are 12.00 mg kg⁻¹, 1.85 mg kg⁻¹, 6.60 mg kg⁻¹, 44.79 mg kg⁻¹, 350.97 mg kg⁻¹, 9.2 mg kg⁻¹, 53.32 mg kg⁻¹ in skin of *Cucurbita melo* growing in Peja, respectively. The mean levels of minerals iron, copper, zinc, magnesium, calcium, sodium and potassium are 36.62 mg kg⁻¹, 4.88 mg kg⁻¹, 6.51 mg kg⁻¹, 75.26 mg kg⁻¹, 253.44 mg kg⁻¹, 10.58 mg kg⁻¹, 110.68 mg kg⁻¹ in seeds of *Cucurbita melo* growing in Peja, respectively. Fig. 7 shows the minerals quantity in the flesh, skin and seeds in *Curcubita melo* growing in Peja.

Fig. 7 shows that *Cucurbita melo* growing in Peja contains large amounts of potassium in skin (350.97 mg kg⁻¹) and seeds (253.44 mg kg⁻¹). Also in the flesh, skin

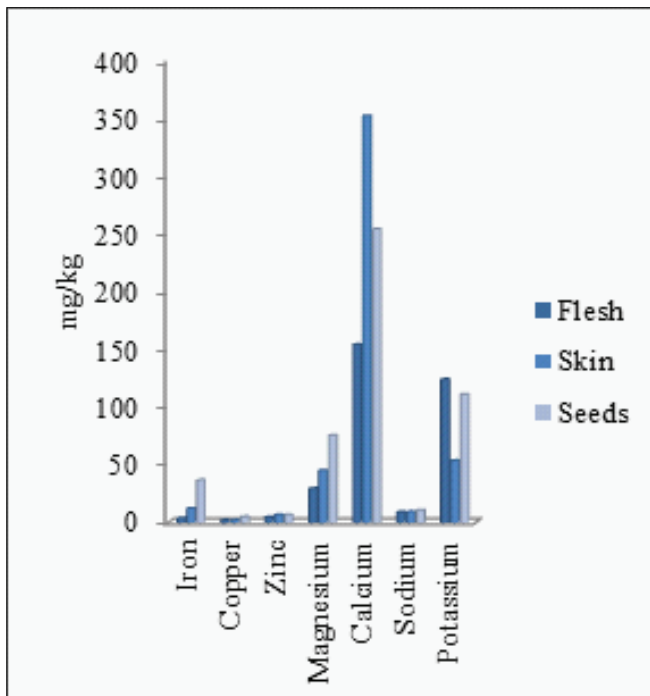


Figure 7. Diagram of the quantity of elements in flesh, skin and seeds of *Cucurbita melo* growing in Peja

magnesium, calcium, sodium and potassium in *Cucurbita melo* growing in Obiliq and in Peja in seeds is lower than the amount of from Ghana (35 %) (Stainer et al., 2014).

Conclusion

Lipids, proteins, carbohydrates, moisture, ash and minerals, were quantitatively determined from the *Cucurbita melo* growing in Obiliq and Peja. From our results we can conclude: (1) The amount of lipids in *Cucurbita melo* growing in Obiliq is higher in seeds (19.4 %). Also the amount of lipids in *Cucurbita melo* growing in Peja is higher in seeds (14.00 %). From the results outlined above we can say that the *Cucurbita melo* contains sufficient amounts of lipids; (2) The amount of proteins in *Cucurbita melo* growing in Obiliq is higher in seeds (13.70 %). Also the amount of proteins in *Cucurbita melo* growing in Peja is higher in seeds (12.70 %). From the results outlined above we can say that the *Cucurbita melo* contains sufficient amounts of proteins; (3) The amount of carbohydrates ranges from 9.60 % to 25.77 %; (4) The amount of proteins, lipids carbohydrates and moisture in *Cucurbita melo* growing in Obiliq is higher than the amount of proteins, lipids, carbohydrates and moisture in *Cucurbita melo* grow-

and seeds the amount of copper, iron and zinc is low. Potassium in large quantities found in flesh ($123.56 \text{ mg kg}^{-1}$) and in seeds ($110.68 \text{ mg kg}^{-1}$). The amount of sodium in all parts of *Cucurbita melo* growing in Peja is almost same.

Cucurbita melo growing in Obiliq, contains more potassium than other elements. The potassium is more concentrated in skin than other parts of *Cucurbita melo*. *Cucurbita melo* growing in Peja, contains more calcium than other elements. The calcium is more concentrated in skin than other parts of *Cucurbita melo*.

The amount of the minerals iron, copper, zinc,

ing in Peja; (5) Order of minerals is as follows: $\text{Ca} > \text{K} > \text{Mg} > \text{Na} > \text{Fe} > \text{Zn} > \text{Cu}$. Thus *Cucurbita melo* contains large amounts of calcium and potassium. It is important to know that we haven't found heavy metals like lead, chrome, mercury and cadmium in *Cucurbita melo*; (6) Based on the results obtained we can conclude that *Cucurbita melo* can be used in the food industry, either as a single product or as a nutritional additive in food, since it is rich in biomolecule and minerals.

NOTES

1. http://www.aoac.org/imis15_prod/AOAC_Docs/OMA/OMA19Revisions.pdf
2. <http://www.bucksci.com/atomic-absorption-spectrophotometers.html>
3. https://www.ars.usda.gov/SP2UserFiles/Place/80400525/Data/SR25/sr25_doc.pdf

REFERENCES

- Achu, M.B., Fokou, E., Tchélégang, C., Fotso, M. & Tchouanguep, F.M. (2007). Nutritive value of some Cucurbitaceae oilseeds from different regions in Cameroon. *African J. Biotechnology*, 4, 1329 – 1334.
- Badifu, G.I.O. (1991). Chemical and physical analyses of oil from four species of cucurbitaceae. *J. Amer. Oil Chemists Soc.*, 68, 428 – 431.
- Badifu, G.I.O. (2001). Effect of processing on proximate composition, antinutritional and toxic contents of kernels from cucurbitaceae species grown in Nigeria. *J. Food Composition & Analysis*, 14, 153 – 161.
- Carbin, B.E., Larsson, B. & Lindahl, O. (1999). Treatment of benign prostatic hyperplasia with phytosterols. *British J. Urol.*, 66, 639 – 641.
- DeMello, M.L.S., Narain, N. & Bora, P.S. (2000). Characterization of some nutritional constituents of melon (*Cucumis melo* hybrid AF-522) seeds. *Food Chem.*, 68, 411 – 414.
- Dvorkin, L. & Song, K.Y. (2002). Herbs for benign prostatic hyperplasia. *Annals Pharmacotherapy*, 36, 1443 – 1452.
- Glew, R.H., Glew, R.S., Chuang, L.T., Huang, Y.S., Millson, M., Constans, D. & Vanderjagt, D.J. (2006). Amino acid, mineral and fatty acid content of pumpkin seeds (*Cucurbita* spp) and *Cyperus esculentus* nuts in the Republic of Niger. *Plant Foods Human Nutr.*, 61, 51 – 56.
- Idouraine, A., Kohlhepp, E.A. & Webber, C.W. (1995). Nutrient constituents from eight lines of naked seed squash (*Cucurbita pepo* L.). *J. Agric. & Food Chem.*, 44, 721 – 724.
- Jensen, W.B. (2007). The origin of the Soxhlet extractor. *J. Chem. Educ.*, 84, 1913 – 1914.
- Kim, M.Y., Kim, E.J., Kim, Y.-N., Choi, C. & Lee, B.-N. (2012). Comparison of the chemical compositions and nutritive values of various

- pumpkin (Cucurbitaceae) species and parts. *Nutrition Res.&Practice*, 6, 21 – 27.
- Loukou, A.L., Gnakri, D., Djè, Y., Kippré, A.V., Malice, M., Baudoin, J.-P. & Zoro Bi, I.A. (2007). Macronutrient composition of three cucurbit species cultivated for seed consumption in Côte d'Ivoire. *African J. Biotechnol.*, 6, 529 – 533.
- Phillips, K.M., Ruggio, D.M. & Ashraf-Khorassani, M. (2005). Phytosterol composition of nuts and seeds commonly consumed in the United States. *J. Agric. Food Chem.*, 53, 9436 – 9445.
- Rashwan, M.R.A., El-Syiad, S.I. & Seleim, M.A. (1993). Protein solubility, mineral content, amino acid composition and electrophoretic pattern of gourd seeds. *Acta Alimentaria*, 22, 15 – 24.
- Ryan, E., Galvin, K., O'Connor, T.P., Maguire, A.R. & O'Brien, N.M. (2007). Phytosterol, squalene, tocopherol content and fatty acid profile of selected seeds, grains, and legumes. *Plant Foods Human Nutr.*, 62, 85 – 91.
- Sabudak, T. (2006). Fatty acid composition of seed and leaf oils of pumpkin, walnut, almond, maize, sunflower and melon. *Chem. Natural Compounds*, 43, 465 – 467.
- Stainer-Asiedu, M., Nuro-Ameyaw, P., Agbemafle, I., Hammond, S.H. & Tano-Debrah, K. (2014). Nutrient composition and protein quality of four species of the Cucurbitaceae family. *Adv. J. Food Sci. & Technol.*, 6, 843 – 851.
- Stevenson, D.G., Eller, F.J., Wang, L., Jane, J.-L., Wang, T. & Inglett, G.E. (2007). Oil and tocopherol content and composition of pumpkin seed oil in 12 cultivars. *J. Agric. Food Chem.*, 55, 4005 – 4013.
- Teotia, M.S. & Ramakrishna, P. (1984). Chemistry and technology of melon seeds. *J. Food Sci. & Technol.*, 21, 332 – 337.
- Zoro Bi, I.A., Koffi, K.K., Djè, Y., Malice, M. & Baudoin, J.P. (2006). Indigenous cucurbits of Côte d'Ivoire: a review of their genetic resources. *Sciences & Nature*, 3(1), 1 – 9.

✉ **Dr. Arben Haziri (corresponding author)**

Department of Chemistry
Faculty of Natural Sciences
University of Pristina
10000 Pristina, George Bush Street, p.n., Kosovo
E-mail: arbeni77chem@hotmail.com

✉ **Dr. Fatbardh Gashi (corresponding author)**

Department of Chemistry
Faculty of Natural Sciences
University of Pristina
10000 Pristina, George Bush Street, p.n., Kosovo
E-mail: fatbardh_gashi@hotmail.com