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TOTAL POLYPHENOLS AND ANTIOXIDANT ACTIVITY IN SWEET POTATOES (*IPOMOEA BATATAS* L.) AFTER HEAT TREATMENT

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ABSTRACT

Sweet potatoes are reported to be a good source of bioactive compounds. The aim of this study was to evaluate the impact of different heat treatment methods (microwaving, steaming, and baking) and variety on the total polyphenol content and antioxidant activity of three sweet potato varieties – Beauregard (orange-fleshed), O'Henry (white-fleshed), and 414-purple (purple-fleshed). All investigated parameters were determined spectrophotometrically. The total polyphenol content was in the range of 0.53 (O'Henry) – 5.60 mg GAE.g^{-1} DW (414-purple) for raw flesh and 1.68 (O'Henry) – 7.03 mg GAE.g^{-1} DW (414-purple) for raw peel of sweet potatoes. Heat treatments caused an increase of total polyphenol content in sweet potatoes (0.98 (steamed O'Henry) – 28.04 mg GAE.g^{-1} DW (baked 414-purple)). In terms of antioxidant activity, the steamed samples of variety 414-purple showed the highest values of DPPH radical scavenging activity (4.51 µmol TE.g^{-1} DW) and Ferric reducing antioxidant power assay (19.57 µmol TE.g^{-1} DW) compared to the other treatment methods. Spearman´s test showed a strong positive relationship between both used methods for evaluation of antioxidant activity. All studied processing methods positively affected the total polyphenol content and antioxidant activity in sweet potatoes.

Keywords: Sweet potato, Processing, Polyphenols, Antioxidant activity

INTRODUCTION

Sweet potato (*Ipomoea batatas* L.) belongs to the most important economic crop in many Asian, African, and Latin American countries. In recent years, sweet potato has been considered a beneficial food crop worldwide due to its high nutritional potential **(Guo *et al.*, 2019)**. Nowadays, the cultivation of sweet potatoes is spread worldwide thanks to great adaptability to different climatic conditions. It is tolerant to relatively low temperatures in higher altitudes, but it is very sensitive to freezing temperatures **(Lim, 2016)**. Edible roots of sweet potato are the main reason for its cultivation. Not only tuberous roots, but all parts of sweet potato, including leaves and stems, can find application in the human diet or as a feed for animals **(Kwak, 2019)**. The edible roots are long and conically shaped with variously colored flesh and smooth skin **(Jain *et al.*, 2015)**. The flesh color varies from white to orange and purple. Besides the peel or flesh color, different colored varieties of sweet potatoes can also vary in their nutritional and phytochemical composition **(Ayeleso *et al.*, 2016; de Albuquerque *et al.*, 2019)**. Unlike ordinary potatoes (*Solanum tuberosum* L.), sweet potato roots have a much better nutritional composition **(de Albuquerque *et al.*, 2019)**. Starch, protein, dietary fiber, vitamins, and minerals provide energy and nutrients for human health and are abundant in sweet potatoes **(Sun *et al.*, 2019)**. They are also low in fat and cholesterol **(Teow *et al.*, 2007)**. Sweet potatoes are also characterized by a high content of bioactive compounds, such as phenolic acids, flavonoids, anthocyanins, and carotenoids. Besides their antioxidant activity, carotenoids and phenolic compounds give sweet potatoes their distinctive flesh colors **(Donado-Pestana *et al.*, 2012; Sun *et al.*, 2019)**.

The presence of bioactive compounds in sweet potato tubers is directly related to the wide spectrum of potential health benefits, such as antioxidant, immunomodulatory, antitumor, antimicrobial, antidiabetic, antiobesity, and hepatoprotective activities **(Ji *et al.*, 2015; Ayeleso *et al.*, 2016)**. Polyphenols and carotenoids are among the most abundant compounds in sweet potatoes and have several benefits in the human diet **(Wang *et al.*, 2018)**. These compounds represent an important group of natural antioxidants **(Xu *et al.*, 2017)** though, the high antioxidant activity of many foods is especially attached with the occurrence of polyphenols **(Wang *et al.*, 2018)**. Polyphenols represent a large class of secondary metabolites widespread in the plant kingdom. Currently, more than 8000 phenolic structures are known and, based on their chemical structure, they form 5 main classes: phenolic acids, flavonoids, stilbenes, coumarins, and tannins) **(Arfaoui, 2021)**. The presence of many phytochemicals in sweet potatoes attracted not only the attention of researchers but also increased awareness among consumers about the nutritional value of sweet potato and its positive effect on human health **(Aveleso *et al.*, 2016; Mwanga *et al.*, 2017)**.

However, the content of phenolic compounds in sweet potatoes is variety-depending. In fact, differences in composition and the content were also found in the individual morphological parts (flesh and peel) of the sweet potato root **(Harrison *et al.*, 2008)**. The initial content of polyphenols in foods, food matrix, as well as food processing are the most crucial factors influencing the bioavailability of polyphenols. Most fruit and vegetable are consumed processed. Industrial or domestic heat processing (e.g., boiling, baking, steaming, etc.) influence the content of polyphenols, their bioaccessibility, and bioavailability **(Arfaoui, 2021)**.

This study was focused on the determination of the total polyphenol content and antioxidant activity in different sweet potato varieties. Since sweet potatoes are mainly consumed after heat treatment, the effect of different heat treatment methods on the polyphenol content and antioxidant activity was studied.

MATERIAL AND METHODS

Chemicals

Methanol (99.8%), gallic acid (p.a.), DPPH (2,2´-diphenyl-1-picrylhydrazyl), Trolox (2,5,7,8-tetramethylchroman-2-carboxylic acid), TPTZ (2,4,6-tri(2-pyridyl)-*s*-triazine), HCl, and acetic acid, were purchased from Sigma-Aldrich (Sigma Aldrich Chemie GmbH, Steiheim, Germany); Na_2CO_3 and $FeCl_3$ were purchased from CentralChem (Slovakia); sodium acetate was provided by Mikrochem (Slovakia) and Folin-Ciocalteu reagent was purchased from Merck (Merck KGaA, Darmstadt, Germany).

Sweet potato samples preparation

Three sweet potato varieties – Beauregard (orange-fleshed), O'Henry (white-fleshed), and 414-purple (purple-fleshed) were used for the analyses. All cultivars were cultivated in the cadastral area of Vukovar in Eastern Croatia. Approximately 3 kg of sweet potato tubers from each variety were used for extract preparation (raw peel and raw flesh) and further heat processing.

Sweet potatoes were thoroughly cleaned and washed with distilled water (dH_2O). Subsequently, the tubers were peeled, and separated peel was mixed (Grindomix GM 200, Retsch, Haan, Germany; 30 sec) and homogenized. Peeled sweet potatoes (flesh) were washed repeatedly with dH_2O and cut into slices about 3 mm thick. A part of the tubers thus prepared (raw flesh) was mixed (Grindomix GM 200, Retsch, Haan, Germany; 30 sec) and homogenized. The other three parts of the tuber were heat-treated according to methods by **Musilová *et al.* (2020)** as follows: microwaving (5 min, 800 W), steaming (15 min, 97 ± 2 °C), and baking (15 min, 200 °C). After each heat treatment, slices of sweet potatoes were cooled and mixed (Grindomix GM 200, Retsch, Haan, Germany; 30 sec) and then homogenized. Extracts required for analysis were prepared from the homogenized samples in 80% methanol.

To prepare the extracts, 25 g of homogenized material (raw peel and raw, microwaved, steamed, and baked flesh, respectively) was taken and poured with 50 mL 80% methanol. The samples thus prepared were extracted for 12 hours by horizontal shaker (Heidolph Promax 1020, Heidolph Instruments GmbH, Schwabach, Germany). The extracts were filtrated through Muktell No 392 paper (Munktell & Filtrac GmbH, Bärenstein, Germany) and stored in closed 50 mL centrifuge tubes at 4 °C in the refrigerator .

Sample analysis

Determination of total polyphenol content

The total polyphenol content (TPC) was determined spectrophotometrically (spectrophotometer Shimadzu UV-1800, Kyoto, Japan) using Folin-Ciocalteu agent according to the method by **Lachman *et al.* (2006)** as follows: to the aliquot volume of sample extract (0.1 mL) in the volumetric flask (50 mL), the Folin-Ciocalteu reagent was added. 5 mL of 20% sodium carbonate aqueous was added after 3 minutes, and distilled water was added to the mark. Standard solutions of gallic acid for the calibration curve were prepared by the same procedure. Prepared solutions were mixed and left at laboratory temperature for 2 hours. After that, the absorbance of solutions was measured at 765 nm. The total content of polyphenols in samples was expressed as mg gallic acid equivalent per gram of dry weight (mg GAE.g^{-1} DW).

DPPH radical scavenging activity

The method, based on scavenging the stable free radical of 2,2′-diphenyl-1-picrylhydrazyl (DPPH), according to **Brand-Williams *et al.* (1995)**, was used for the determination of antioxidant activity (AA). A stock solution of DPPH free radical was prepared by dissolving 0.025 g of DPPH in methanol (99.8%) in a 100 mL flask and stored in a cold and dark place. For analysis, DPPH working solution was prepared from the DPPH stock solution by mixing with methanol (1:10). The analysis was performed as follows: the absorbance of DPPH working solution at the wavelength of 515.6 nm was measured (A_0) by UV-VIS spectrophotometer (Shimadzu, Kyoto, Japan). Subsequently, 0.1 mL of the sample extract was added to the DPPH solution in the cuvette, evenly mixed, and left to stand for 10 minutes in darkness. After that, the absorbance (A_{10}) was measured. Based on the values of absorbance of DPPH solution (A_0) and the absorbance at time t = 10 minutes (A_{10}) after adding sample extract, the percentage values of DPPH inhibition were calculated for each sample according to the formula:

$$\%\text{DPPH inhibition} = [(A_0 - A_{10}) / A_0] \times 100.$$

The antioxidant activity evaluated by the DPPH method was expressed as μmols of Trolox equivalents per gram of dry weight (μmol TE.g^{-1} DW).

Ferric reducing antioxidant power assay

The ferric reducing antioxidant power (FRAP) assay was performed according to **Firuzi *et al.* (2005)**.The FRAP reagent was prepared by mixing a TPTZ solution (5 mmol.L^{-1} in 40 mmol.L^{-1} HCl), ferric chloride solution (10 mmol.L^{-1}), and acetate buffer (acetic acid, c = 0.1 mol.L^{-1}; sodium acetate, c = 0.1 mol.L^{-1}, pH 3.6) in a ratio of 1:1:10. Sample solutions for determination were prepared as follows: to 6 mL of FRAP reagent in test tubes, 0.1 mL of each sample extract was added, evenly mixed (Heidolph Reax top, Heildolph Instruments GmbH, Schwabach, Germany), and the test tubes were closed. The samples thus prepared were left in a water bath at 37 ° C in the dark for 30 minutes. Standard solutions of Trolox for the calibration curve were prepared by the same procedure as samples. After that, the absorbance at the wavelength of 593 nm was measured (spectrophotometer Shimadzu UV-1800, Kyoto, Japan). The ferric reducing antioxidant power was expressed as μmols of Trolox equivalents per gram of dry weight (μmol TE.g^{-1} DW).

Statistical analysis

All analyses were performed in four repetitions (n = 4). The results were expressed as average ± standard deviation (SD). At first, the dataset was tested for normality. All the tested variables were distributed nonparametric. Therefore, the Kruskal-Wallis test was used for the determination of the statistical differences ($p < 0.05$) between varieties and between heat treatment methods. Spearman's correlation coefficient was used to determine the relationship between investigated parameters (TPC, DPPH, and FRAP). The computational work, including the graphical presentations, was performed using **RStudio (2020)** software package.

RESULTS AND DISCUSSION

Total polyphenol content

Polyphenols represent an important group of secondary plant metabolites playing various roles in plants **(Manach *et al.*, 2004)**. The presence and content of polyphenols generally depend on genetics **(Siracusa *et al.*, 2014)**. Among sweet potato varieties, sweet potatoes with purple flesh are characterized by a high content of polyphenols **(de Albuquerque *et al.*, 2019)**, which was confirmed by our results (Table 1). The concentration of polyphenols compounds is not equal in all parts of sweet potatoes. More than 78% of phenolic substances are found in the peel and surrounding flesh, and their concentration decreases towards the center of the tuber **(Padmaja, 2009; Jung *et al*., 2011; Lim, 2016)**. **Im *et al.* (2021)** reported higher total polyphenol content (TPC) in outer layers of purple sweet potato tubers. The total polyphenol content in investigated raw sweet potato flesh samples was in the range of 0.53 (O'Henry) – 5.60 mg GAE.g^{-1} DW (414-purple) and 1.68 (O'Henry) – 7.03 mg GAE.g^{-1} DW (414-purple) in the raw peel.

TPC in purple-fleshed variety (414-purple) was several times higher than in orange-fleshed (Beauregard) and white-fleshed (O'Henry) sweet potatoes (SP) (Table 1). Some previous studies have reported the highest content of polyphenols in purple sweet potato varieties **(Kim *et al.*, 2015; Cartier *et al.*, 2017)**, which agrees with our results. Variety has the greatest influence on the content of bioactive substances in sweet potatoes **(Teow *et al.*, 2007; Rumbaoa *et al.*, 2009)**. In general, purple varieties of sweet potatoes, in contrast to white, yellow, or orange-fleshed sweet potatoes, are characteristic of high polyphenol content **(Oki *et al.*, 2003; Kurata *et al.*, 2019)**. **Kim *et al.* (2015)** reported from 2- to 5-times higher TPC in purple varieties than in white or orange SP varieties. These differences between varieties are affected by many factors. Genetics is one of the most significant agents playing a crucial role in the production of secondary metabolites, including phenolics, so varieties with various flesh colors have different levels of expression of phenolic compounds **(Donado-Pestana *et al.*, 2012)**.

Comparison with previous studies revealed differences in the measured TPC values. Higher total polyphenol content was determined in Beauregard and O'Henry from Virginia (4.30 and 2.45 mg GAE.g^{-1} DW, respectively) **(Cartier *et al.*, 2017)**. Moreover, **Kourouma *et al.* (2020)** reported higher TPC in 25 SP varieties from China with a pale yellow to orange flesh color (3.13 – 9.38 mg GAE.g^{-1} DW). In 8 varieties of orange sweet potatoes from Africa was measured a lower content of polyphenols than in the studies mentioned above, ranging from 1.062 to 2.432 mg GAE.g^{-1} DW **(Koala *et al.*, 2013)**. **Donado-Pestana *et al.* (2012)** reported TPC in sweet potatoes with orange flesh in the range of 1.30 – 1.93 mg GAE.g^{-1} DW. These values are comparable with results in variety Beauregard (1.42 mg GAE.g^{-1} DW).

Due to the monitored heat treatments (microwaving, steaming, and baking), the TPC increased in the case of all varieties (Beauregard, O'Henry, and 414-purple). In heat-treated samples, TPC values ranged between 0.98 (O'Henry – steaming) and 28.04 mg GAE.g^{-1} DW (414-purple – baking). TPC in the varieties O'Henry and 414-purple increased in order of raw flesh < steaming < microwaving < baking. In variety Beauregard, TPC increased in the following order: raw flesh < microwaving < steaming < baking. In baked SP of all monitored varieties, the greatest increase of TPC was observed compared to raw flesh. An increase of total polyphenol content in sweet potatoes due to heat treatment has been reported in previous studies by many authors **(Dincer *et al.*, 2011; Ateea *et al.*, 2012; Musilová *et al.*, 2017; Nicoletto *et al.*, 2018; Xu *et al.*, 2018)**. In variety Beauregard, **Ateea *et al.* (2012)** reported the highest polyphenol content after boiling and microwaving (2.8 and 2.6 times higher TPC than in raw sample). In white sweet potatoes, steaming led to the highest increase of total polyphenols **(Nicoletto *et al.*, 2018)**. Heat treatments, such as microwaving and steaming, can cause cell structure disruption, which can result in better extraction of compounds from the cell matrix **(Tian *et al.*, 2016; Minatel *et al.*, 2017; Nicoletto *et al.*, 2018)**. On the other hand, some authors reported a decrease in TPC in sweet potatoes due to heat processing **(Donado-Pestana *et al.*, 2012; Xu *et al.*, 2018; Kourouma *et al.*, 2020)**. **Xu *et al.* (2018)** reported a decrease of TPC in heat-treated samples of Beauregard variety while, in the purple variety, there was an increase in TPC due to heat treatment (the highest increase after boiling). Purple variety was also reported to have the highest TPC in raw and all processed samples. In orange-fleshed sweet potatoes from Brazil, heat-processing methods led to a significant loss of TPC. However, the phenolic compounds resisted heat treatment better than carotenoids **(Donado-Pestana *et al.*, 2012)**. The impact of heat treatment on TPC depends on many factors, such as variety, the temperature of heat treatment, heat treatment method, etc. **(Xu *et al.*, 2018)**.

Figure 1 shows the relationship between sweet potato variety and TPC. There is a very strong significant difference in TPC between sweet potato varieties ($p=1.5e^{-}$

[08]). A significantly higher content of polyphenols was found in variety 414-purple, which was confirmed by the Kruskal-Wallis test.

Table 1 Total polyphenol content and antioxidant activity in raw and heat-treated sweet potatoes

Variety	Heat treatment	TPC (mg GAE.g^{-1} DW)	Antioxidant activity	
			DPPH (µmol TE.g^{-1} DW)	FRAP (µmol TE.g^{-1} DW)
Beauregard	Raw flesh	1.42 ± 0.18	1.35 ± 0.01	3.15 ± 0.40
O'Henry		0.53 ± 0.03	0.70 ± 0.02	1.50 ± 0.05
414-purple		5.60 ± 0.13	2.98 ± 0.04	8.21 ± 0.05
Beauregard	Raw peel	2.64 ± 0.26	7.91 ± 0.10	39.00 ± 0.42
O'Henry		1.68 ± 0.17	4.80 ± 0.04	15.90 ± 0.59
414-purple		7.03 ± 0.07	7.00 ± 0.03	29.99 ± 0.06
Beauregard	Microwaving	1.45 ± 0.11	2.53 ± 0.03	7.42 ± 0.28
O'Henry		3.32 ± 0.18	2.35 ± 0.02	6.55 ± 0.23
414-purple		21.98 ± 0.13	3.07 ± 0.01	13.37 ± 0.07
Beauregard	Steaming	5.08 ± 0.12	2.72 ± 0.44	6.11 ± 0.33
O'Henry		0.98 ± 0.09	2.19 ± 0.08	3.87 ± 0.36
414-purple		11.84 ± 0.09	4.51 ± 0.01	19.57 ± 0.09
Beauregard	Baking	8.01 ± 0.17	2.52 ± 0.01	6.47 ± 0.32
O'Henry		3.55 ± 0.20	2.22 ± 0.02	6.20 ± 0.11
414-purple		28.04 ± 0.09	2.44± 0.00	10.73 ± 0.09

Legend: TPC – Total polyphenol content, GAE – gallic acid equivalent, DW – dry weight, DPPH – 2,2´-diphenyl-1-picrylhydrazyl, TE – Trolox equivalents, FRAP – Ferric reducing antioxidant power. The values are expressed as average ± SD.

Antioxidant activity

The analysis of the antioxidant activity of natural products is the basis for the evaluation and recommendation of foods with high antioxidant activity to consumers **(Xu *et al.*, 2017)**. Antioxidant activity (AA) of sweet potatoes was determined by DPPH free radical scavenging activity and ferric reducing antioxidant power (FRAP) assay.

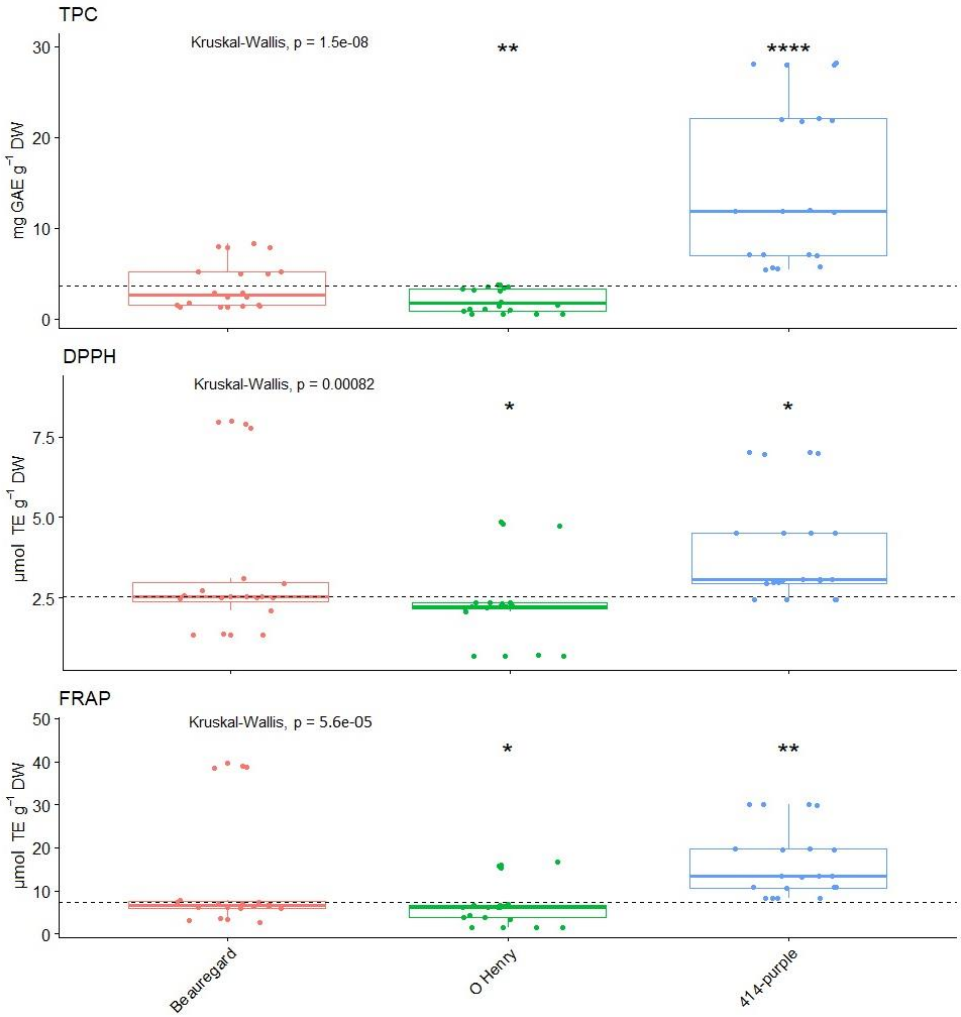

Figure 1 Statistical differences in total polyphenol content (TPC) and antioxidant activity (DPPH and FRAP) between monitored sweet potato varieties. The dashed line presents the average value for TPC, DPPH, and FRAP, separately.

The FRAP values varied from 1.50 (O'Henry) to 8.21 µmol TE.g^{-1} DW (414-purple) in raw flesh and from 15.9 (O'Henry) to 39.0 µmol TE.g^{-1} DW (Beauregard) in the raw peel. The antioxidant activity assessed by the DPPH method varied from 0.70 (O'Henry) to 2.98 µmol TE.g^{-1} DW (414-purple) in raw sweet potato flesh. By comparing individual parts (flesh and peel) of raw sweet potato, higher AA values were measured in the peel (4.80 µmol TE.g^{-1} DW in variety O'Henry – 7.91 µmol TE.g^{-1} DW in variety Beauregard) (Table 1). Among the monitored varieties, the highest AA was detected in the purple variety (414-purple), which corresponds to the results of previous studies, which also show the highest antioxidant activity in purple-fleshed varieties compared to white and orange-fleshed **(Teow *et al.*, 2007; Padda *et al.*, 2008; Donado-Pestana *et al.*, 2012; Cartier *et al.*, 2017)**. The presence of anthocyanins in purple SP varieties may result in higher AA compared to white or orange-fleshed sweet potato varieties **(Oki *et al.*, 2002)**. In variety Beauregard, the average AA in raw flesh was 1.35 µmol TE.g^{-1} DW. This result is comparable to **Ateea *et al.* (2012)**, which reports 1.72 µmol TE.g^{-1} DW (raw flesh – Beauregard). The antioxidant activity in white-fleshed SP from Nigeria was 0.23 and 0.26 µmol TE.g^{-1} DW in raw flesh and raw peel, respectively **(Salawu *et al.*, 2015)**. In contrast, higher AA was detected in Beauregard and O'Henry varieties from Virginia (11.8 and 3.17 µmol TE.g^{-1} DW) **(Cartier *et al.*, 2017)**.

Regarding antioxidant activity, there is a strong significant difference between varieties in DPPH ($p=8.2e^{-04}$) and FRAP ($p=5.6e^{-05}$) (Figure 1). The highest antioxidant activity evaluated by both methods, DPPH and FRAP, was found in variety 414-purple. Kruskal-Wallis test showed a strong dependence of antioxidant activity on sweet potato variety.

In heat-treated sweet potatoes, antioxidant activity evaluated by DPPH assay ranged between 2.19 (O'Henry – steaming) and 4.51 µmol TE.g^{-1} DW (414-purple – steaming). The antioxidant activity of sweet potatoes increased due to heat treatments; a decrease of AA compared to raw flesh was observed only in 414-purple variety after baking (2.44 µmol TE.g^{-1} DW). Antioxidant activity in individual varieties of sweet potatoes assessed by DPPH increased in the following order: raw flesh < baking < microwaving < steaming in variety Beauregard; raw flesh < steaming < baking < microwaving in variety O'Henry; baking < raw flesh < microwaving < steaming in variety 414-purple. An increase of AA due to heat treatment was also reported previously **(Ateea *et al.*, 2012; Nicoletto *et al.*, 2018; Xu *et al.*, 2018)**. This phenomenon has already been reported in many other vegetables, such as spinach, broccoli, peppers, etc. **(Turkmen *et al.*, 2005)**. In boiled and microwaved samples of Beauregard SP, **Ateea *et al.* (2012)** detected up to 3.70 and 3.50 -fold increase of AA compared to the raw sample. This fact may be the result of the destruction of complex components in sweet potatoes by heat **(Kim *et al.*, 2019)**. Newly generated substances during heat treatment may contribute to the increase of AA of sweet potatoes **(Kourouma *et al.*, 2019)**. In varieties Beauregard and 414-purple, the highest AA was detected in steamed samples. Moreover, **Xu *et al.* (2018)** reported the highest increase of AA in variety Beauregard and purple variety (Purple) after steaming compared to other heat treatments. The increase of antioxidant activity after heat treatment can be a result of the release of phenolic compounds due to the breakdown of cell structures by heat. The heat releases enzymes that cleave antioxidants, temperatures above 80 °C deactivate these enzymes, which prevents the loss of phenolic compounds **(Minatel *et al.*, 2017)**. The level of increase of AA after heat treatment is also affected by SP variety **(Xu *et al.*, 2018)**.

Statistical analysis confirmed the differences ($p < 0.05$) between heat treatment methods/individual morphological parts of SP (raw flesh and raw peel) in all investigated parameters (TPC, DPPH, and FRAP) (Figure 2). Regarding individual morphological parts of sweet potato, peel showed statistically higher antioxidant activity (DPPH and FRAP) than flesh. Considering heat processing, no significant difference was found in antioxidant activity between investigated heat treatment methods. From Figure 2, we can conclude that statistically higher TPC was observed in baked sweet potato samples. All obtained data were statistically confirmed.

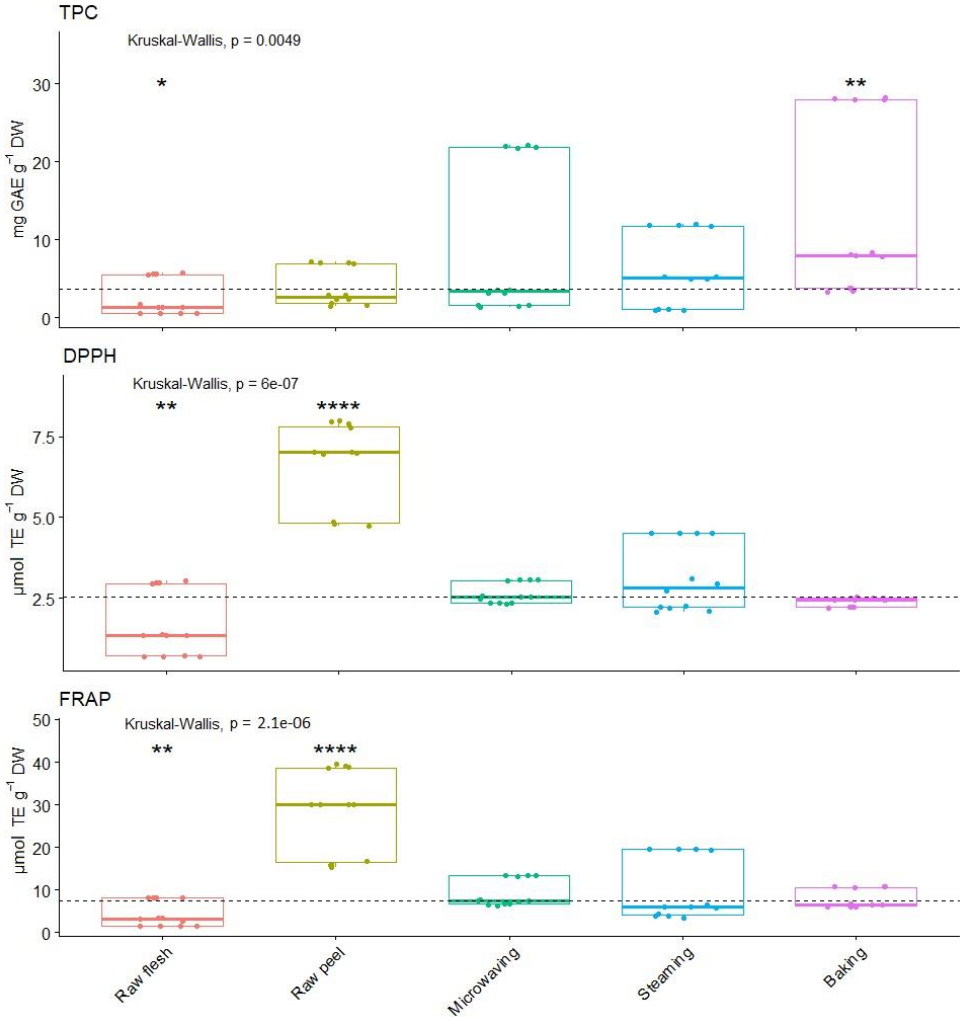

Figure 2 Statistical differences in total polyphenol content (TPC) and antioxidant activity (DPPH and FRAP) between heat treatment methods of sweet potatoes. The dashed line presents the average value for TPC, DPPH, and FRAP, separately.

Spearman's correlation test

Spearman´s correlation coefficient was used to determine relationships between monitored parameters – total polyphenol content and antioxidant activity (DPPH and FRAP) (Figure 3).

According to our results, among all analyzed parameters, positive correlations were observed. Phenolic compounds contribute most to the capability to scavenge DPPH free radicals, and thus, to the antioxidant activity of sweet potatoes **(Cartier *et al.*, 2017)**. The total polyphenol content in investigated sweet potato samples showed a positive relationship with antioxidant activity. TPC positively correlated with DPPH free radical scavenging activity (r = 0.43) and FRAP (r = 0.52).

A very strong positive correlation was detected between both antioxidant activity methods – DPPH and FRAP (r = 0.89, p < 0.0001). Therefore, it can be suggested that both methods have comparable ability to predict the antioxidant activity of sweet potatoes.

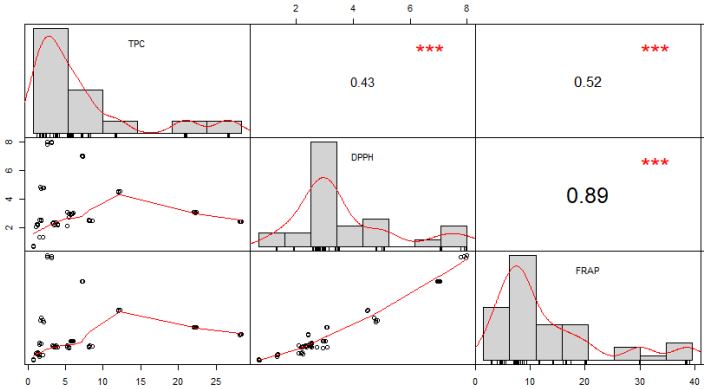

Figure 3 Correlations between total polyphenol content (TPC) and antioxidant activity (DPPH and FRAP).

CONCLUSION

The present study provides information on the content and the influence of heat treatment on polyphenols and antioxidant activity in three sweet potatoes varieties – Beauregard, O'Henry, and 414-purple. Overall, the highest content of polyphenols and antioxidant activity was observed in the purple-fleshed variety 414-purple. All studied processing methods positively affected the total polyphenol content and antioxidant activity in sweet potatoes. Statistical analysis confirmed the differences between the monitored varieties, as well as between the heat treatment methods.

Information provided by our study can bring a more complex knowledge of the processing impact on the content of bioactive compounds and the antioxidant activity of sweet potatoes.

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