PRELIMINARY STUDY REGARDING TO THE TOTAL POLYPHENOLS AND ANTIOXIDANT CAPACITY OF YELLOW MAIZE CORNCOBS

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Abstract

The aim of the present study was to investigate corncob of yellow maize (which is a plant residue) from point of view of bioactive compounds like polyphenols and the antioxidany capacity. Six corncobs of yellow maize hybrids were analyses and compared to purple corn (Peru). The values obtained for total phenol content (TPC), expressed as mg GAE/100 g dw, in corncobs of yellow maize, decreased in the order: Turda 200 > Turda STAR > Turda 20A > Turda Favorit > Florencia >Fundulea. The highest values of TPC was recorded for Peru followed by Turda 200 corncobs (750.91 mg GAE/100g dw, respectively 703.98 mg GAE/100g dw). Antioxidant properties of corncob extracts were determined by two methods: DPPH and FRAP. The higest DPPH radical-scavenging activity was recorded in the case of Fundulea corncobs and the highest antioxidant power was recorded in the case of corn cob Peru followed by Turda 200 corncobs. The results obtained in the case of hybrids of corn maiz shows that this residue source can be used in pharmaceutical field, to obtain the supplements rich in bioactive compounds.

Key words: cob maize, total polyphenols, antioxidant, DPPH, FRAP

INTRODUCTION

Zea mays L (corn) is a widely consumed cereal in Romania mainly in the form of products as *mamaliga*. Also, the maize is widely consumed cereal in other countries like Mexico and Central America in the form of products as tortilla and tortilla chips (Lopez Martinez et al, 2009). Regarding to chemical composition, pigmented corn (purple and yellow) contains secondary metabolites (anthocyanins, carotenoids, and phenolic compounds) with hight antioxidant activity and biological properties with health benefits. The bioactive compounds, shown in an increasing interest due to various biological activities such as antioxidant (Aqil et al., 2006, Ku et al., 2014), antimutagenic and chemopreventive effects (Stoner et al., 1995). These secondary metabolites are soluble pigments that are responsible to the color of most fruits, vegetables and flowers.

One of the rich source of anthocyanins is purple corn, that has been cultivated in South America, where are used to prepared drinks and desserts (Pu Jing, 2006). The researches shown that the content of anthocyanins from purple corn are about 1640mg/100g fresh weight, much higher than other anthocyanin-rich sources. The main compounds from the anthocyanin class

in purple corncob is Cyanidin-3-glucoside, although pelargonidin and peonidin glucosides as well as their respective malonyl derivatives.
Our aim was to characterized six hybrids of corncob of yellow maize from Romanian regarding to the content of bioactive compounds, such as polyphenols and its antioxidant capacity and compared with purple corncob and seed (Peru).

MATERIALS AND METHODS

Preparation of corncob extracts

To study the total phenol compounds and antioxidant capacity the corncobs from six yellow maize were investigated. These corncobs were kindly provided from Fundulea Institute and were: Turda 20A, Turda STAR , Turda 200, Turda Favorit , Florencia , Fundulea. The pellets of corncobs were homogenized with distillated water in ratio to 1:10 (w/v), and then, the samples were centrifugates at 5000 rpm for 20 minutes, and from supernatants were evaluated the total phenols and antioxidant capacity.

UV-Vis spectroscopy fingerprint of corncob extracts

UV-VIS spectroscopy fingerprints of corncob extracts were performed between 250 and 950 nm, after a prior dilution of extracts, using a Shimadzu UV-VIS 1240 mini, Shimadzu Corp. Kyoto, Japan spectrophotometer.

Analyses of total polyphenol compounds(TPC) from corncobs extracts

Total phenolic content was determined by the Folin-Ciocalteu method (Singleton *et al.*, 1999). This method combined 100 µl corncob maize extracts, 2000 µl distillated water and 200 µl Folin-Ciocalteu reagent; then mixed well using a vortex. The mixture was allowed to react for 3 minutes, and then 1 ml of 15% Na_2CO_3 solution was then added and mixed well. The samples were incubated at room temperature, in the dark for 2 hours. The absorbance was taken at 750 nm using a spectrophotometer (Shimadzu, mini UV-Vis). The results were expressed in gallic acid equivalents (mg GAE /g dry weight).

Determination of antioxidant capacity of corncobs extracts

DPPH assay

The DPPH radical-scavenging activity was determined using the method proposed by Brand-Williams *et al.* (1995). A volume of 200 µl sample and 2.8 ml DPPH solution (80 µM) were mixed and the decrease in the absorbance of the resulting solution was monitored at 515 nm for 5 minutes. The percentage of scavenging effect of different extracts against DPPH radicals, was calculated using the following equation: DPPH scavenging effect (%) = $[(A_0-A_s) \times 100]/A_0$, where, A_0 is absorbance of the blank, and A_S is absorbance of the samples at 515 nm.

FRAP assay

The FRAP assay, a simple test of the total antioxidant power have chosen to assess the presumable effects of aqueous extracts of corn *cob maize*, and was determined according to the method of Benzie and Strain (1996). The FRAP assay depends upon the ferric tripyridyltriazine (Fe(III)-TPTZ) complex to the ferrous tripyridyltriazine (Fe(II)-TPTZ) by a reductant at low pH. Standard solution of Trolox (1mg/ml) in distillated water was prepared. The results are expressed as mg equivalent Trolox/1g dry weight.

Statistical analysis

All values are expressed as mean ± S.D. Data were subjected to one-way analysis of variance (ANOVA) and comparison among means was determined according to Tukey's test, significant differences were accepted at $P < 0.05$. The statistical tests were generated with GraphPad Prism version 5.00 for Windows.

RESULTS AND DISCUSSION

Before starting to investigate the total polyphenols we made a UV-Vis spectra fingerprint (190-600 nm) of methanol extracts from all the cornbob samples in order to establish were these extracts have the maximum absorption specifically bioactive compounds. The UV absorption spectra obtained for six hybrids corncob of yellow maize and both corncob and seed of Peru maize can be seen in Figure 1. The spectra of yellow corncobs showed characteristic peaks of polyphenols (270-280 nm typical for phenolic acids and flavonoids) and in the case of Peru maize characteristic peaks are recorded to 270-280 nm and 535 nm specific to anthocyanins.

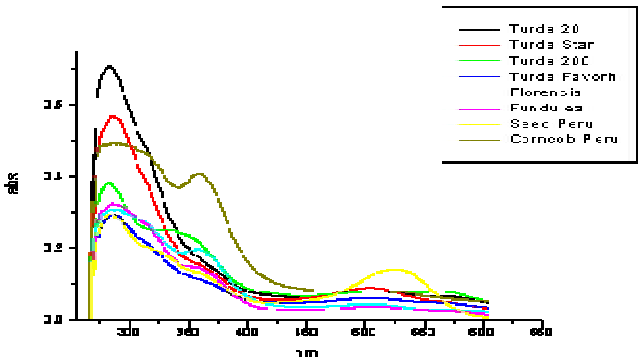

Fig. 1. The UV-Vis absorption spectra of six hybrids corncob of yellow maize, Peru corncob and Peru seed maize

Total polyphenols content ranged from 292.82 to 750.91 mg GAE/100 g dw, and the results are shown in Table 1. Between the yellow hybrids corncob the highest levels of TPC are recorded in the case of Turda 200 (703.98 mg GAE/100 g dw) and the lowest level in the case of Fundulea

(469 mg GAE/100 g dw). The corncob Peru content the highest level of polyphenols (750.91 mg GAE/100 g dw) compared with the yellow maize, instead in the Peru seed a low content in total polyphenols (292.82 mg GAE/100 g dw) was recorded .

To evaluate the antioxidant capacity of polyphenols, we used two different methods, with different principle. The first, DPPH, is an antioxidant assay based on electron-transfer that spectrophotometry measure the ability of the extracts to inhibit the violet solution of stable free radical DPPH and given a colorless solution. The second method used was FRAP, that measure the antioxidant power of the extracts based on the conversion of ferric tripyridyltriazine (Fe(III)-TPTZ) complex to the ferrous tripyridyltriazine (Fe(II)-TPTZ) by a reductant at low pH.

Table 1

The total polyphenols content (mg GAE/100 gdw) from yellow six hybrids corncobs and from both Peru corncob and seed

SAMPLES	**MG GAE/100 G DW**	**SD**
Turda 20A	530.25[a]	0.0113
Turda STAR	545.80[b]	0.0113
Turda 200	703.98[c]	0.0269
Turda Favorit	524.61[d]	0.0156
Florencia	487.00[e]	0.0184
Fundulea	469.79[f]	0.0290
Peru (seed)	292.82[g]	0.0240
Peru (corncob)	750.91[i]	0.0339

Mean values are followed by different letters if are significantly different, according to Tukey's test. ($P<0.05$).

Beetwen all the samples examined, we observed significantly differences ($p < 0.05$) regarding to the DPPH scavenging effect (%) of all corncob hybrids, except for Turda 20 and Peru corncobs. The results (Figure 2), showed that the highest scavenging effect was recorded in the case of Fundulea followed by Turda Favorit and Turda 200 corncobs (30.27%, 27.30% and 25.95% respectively).

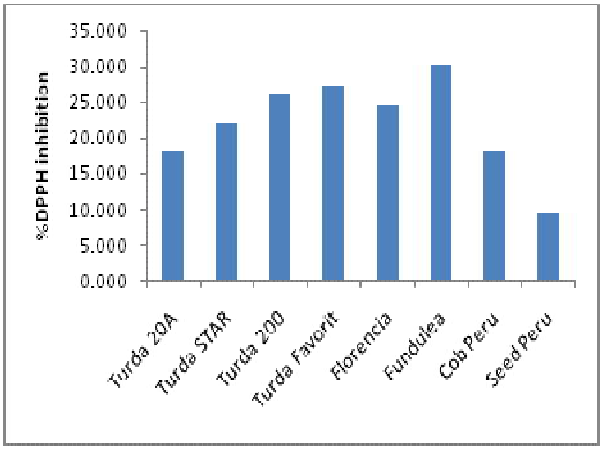

Fig. 2. The DPPH· scavenging effect (%) of six yellow corncob maize hybrids and Peru corncob and seeds (purple maize).

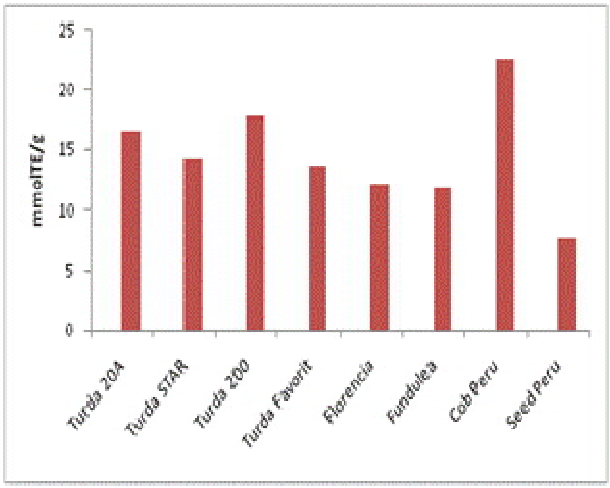

Fig. 3. Total antioxidant power (FRAP assay) of six yellow corncob maize hybrids and Peru corncob and seeds (purple maize).

The ferric-reducing antioxidant power (FRAP) of six yellow corncob maize hybrids and Peru corncob and seeds are shown in Figure 3, and the results are expressed as mmol Trolox equivalent/g dw sample. Between all samples, the highest antioxidant power was recorded in the case of corncob Peru (22.51 mmol TE/g) and the lowest power was for Fundulea corncobs (11.91 mmol TE/g).

CONCLUSIONS

Six yellow corncob maize hybrids were evaluated from point of view of total poliphenol content and antioxidant capacity. Between the

samples, the highest content in bioactive compound such polyphenols and antioxidant power were recorded in Turda 200 corncobs.

Our results shown for the first time in literature that the corncobs provided from the yellow maize may provide a new source of antioxidants and can be potential plant resources for use in food and medicinal purposes.

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