Determination of polyphenolic composition in apple (*Malus domestica Borkh.*) fruits

Mindaugas Liaudanskas[1], Raimondas Raudonis[1], Valdas Jakštas[1], Pranas Viškelis[2], Darius Kviklys[2], Juozas Lanauskas[2], Nomeda Kviklienė[2], Valdimaras Janulis[1]

[1]Department of Pharmacognosy, Lithuanian University of Health Sciences, Mickevičiaus Str. 9, LT-44307, Lithuania, farmakog@lsmuni.lt

[2]Institute of Horticulture, Lithuanian Research Centre for Agriculture and Forestry, Kauno g. 30, LT-54333 Babtai, Kaunas distr., Lithuania, biochem@lsdi.lt

Introduction

Polyphenolic compounds are one of the phytochemical groups whose protective properties include antioxidant, antimicrobial, anticancer and cardiovascular protective activities. In numerous diets, apples are a very significant part and represent an important source of bioavailable polyphenolic compounds such as flavonols (with quercetin glycosides as the main representative), dihydrochalcones (e.g.phoridzin), flavan-3-ols and phenolic acids [1].

The objective of this study was to investigate the profiles of polyphenolic compounds in different apple cultivars. A new HPLC method was created and developed.

Materials and methods

Four apples cultivars (Auksis, Ligol, Lodel and Rajka) were studied. Apples were cut into pieces and lyophilised. Samples of apple lyophilisate were extracted with 70% ethanol (v/v) using ultrasonic bath.

HPLC analysis was performed on a Waters 2695 HPLC Separation Module equipped with a Waters 2998 Photodiode Array Detector. Seperations were carried out using a 5 µm YMC C_{18} analytical column (250×4,6 mm I.D.) guarded with guard column (10×3,0 mm I.D.). The mobile phase was a mixture of 2% (v/v) acetic acid in water (eluent A) and 100% (v/v) acetonitrile (eluent B). The column was operated at a temperature of 25°C. The gradient program was as follows: 0-30 min 3-15% B, 30-45 min 15-25% B, 45-50 min 25-50% B, 50-55 min 50-95% B. Simultaneous monitoring was performed at 280 nm (dihydrochalcones, flavan-3-ols), 320 nm (phenolic acids) and 360 nm (flavonols) at a flow-rate of 1 ml/min. Spectra were recorded from 200 to 600 nm. The identification of polyphenolic compounds was achieved by comparing their retention times and UV-Vis spectra with those of standards.

All values in the text and diagrams are means of triplicate analysis. Error bars in the diagrams represent standart deviation (SD). In the text values are presented as mean±SD µg/g of dry weight (DW).

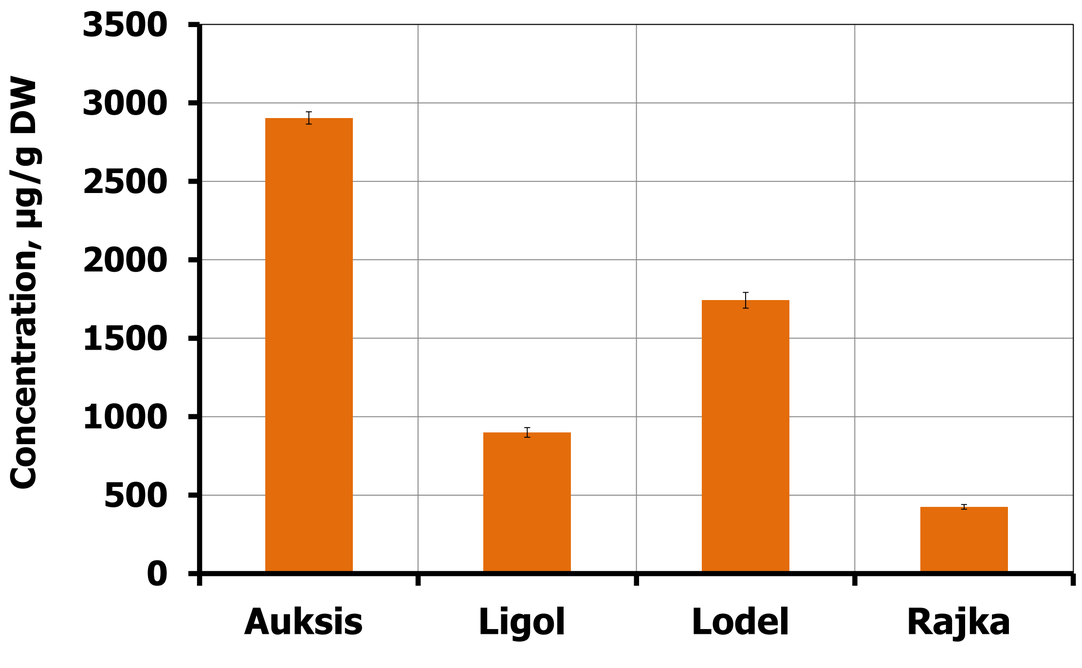

Figure 1. Concentration of chlorogenic acid in apples of tested cultivars

Results

Eight polyphenolic compounds from different groups such as flavonols, phenolic acids, flavan-3-ols and dihydrochalcones were detected in the apples. The most abundant component in all apple cultivars was chlorogenic acid (the largest amount in cv. Auksis 2903.83±39.21 µg/g DW). Figure 1.

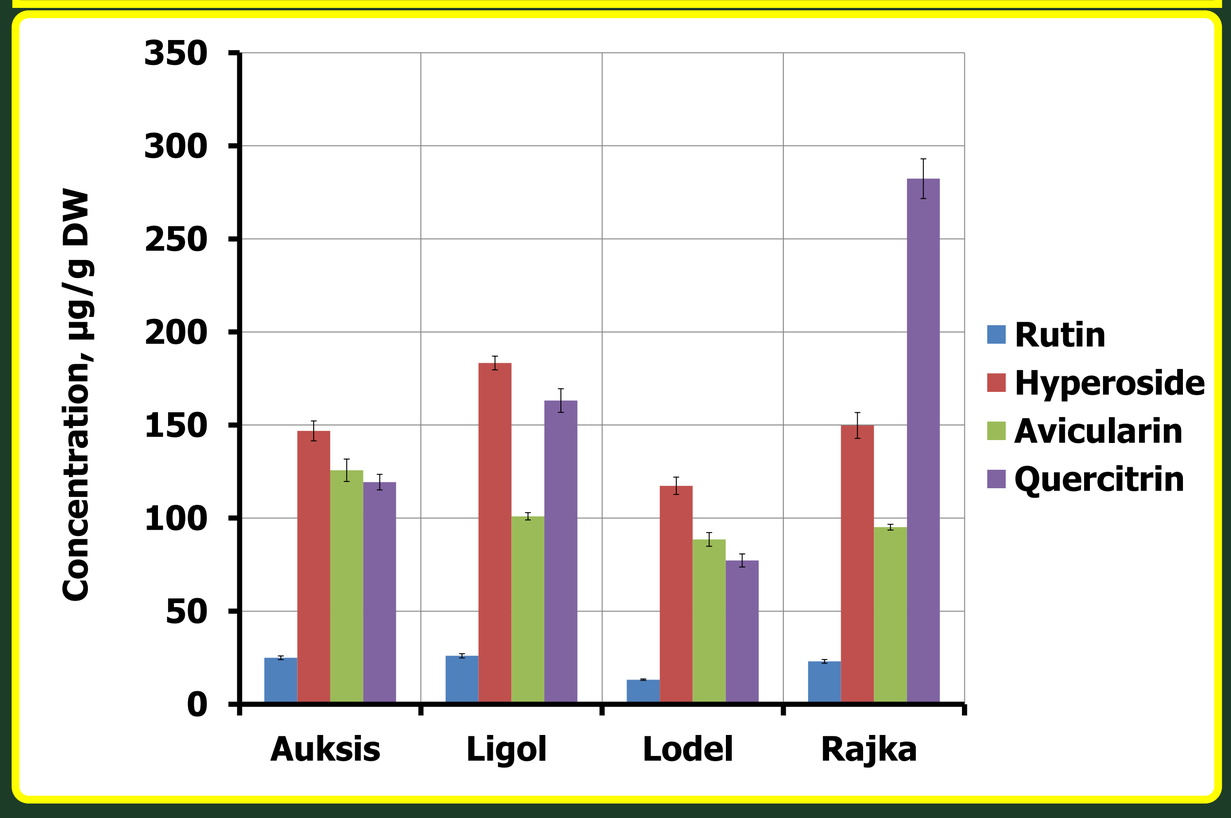

Figure 2. Concentrations of quercetin glycosides in apples of tested cultivars

The fruit of all apple cultivars tested contained four quercetin glycosides, namely hyperoside, rutin, avicularin and quercitrin. Hyperoside was the predominant form in all cultivars (the largest amount in cv. Ligol 183.32±3.69 µg/g DW) except for Rajka.

Dominant form of flavonols in cv. Rajka was quercitrin (282.35±13.65 µg/g DW). Figure 2.

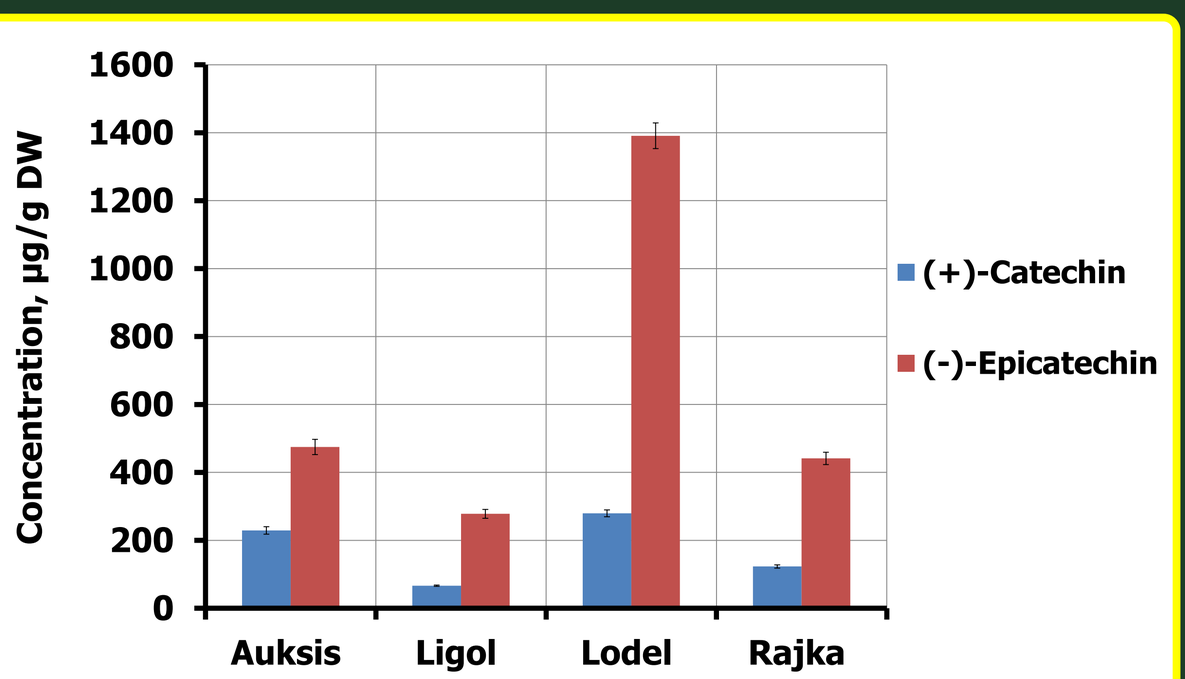

Figure 3. Concentrations of monomeric flavan-3-ols in apples of tested cultivars

The largest amount of phloridzin (160.09±6.32 µg/g DW) and monomeric flavan-3-ols - (+)-catechin (279.47±10.01) and (-)-epicatechin (1391.03±37.65 µg/g DW) was evaluated in cv. Lodel. Figures 3 and 4.

Figure 4. Concentration of phloridzin in apples of tested cultivars

Conclusion

The results obtained in this study give new actual information about composition of polyphenolic compounds in tested apple cultivars. This method of evaluation of polyphenolic compounds in apple fruits will be used in our further investigations. The procedure of method validation is going to be performed.

Acknowledgement. This work was supported by a grant from the Research Council of Lithuania, No. SVE-02/2011.

References

1. Ćetković G., Čanadanović-Brunet J., Djilas S., Savatović S., Mandić A., Tumbas V. Assessment ot polyphenolic content and *in vitro* antiradical charakteristics of apple pomace. Food Chemistry 109 (2008) 340-347.