Abstract
Since ancient times plants have constituted a very important raw material for many human activities. The increasing interest in the powerful biological activity of plants emphasized the importance of determining phenolics’ and flavonoids’ content in medicinal plants. The aim of this study was to perform a comparative evaluation of three selected herbs (lemon balm, mint and sage), commercially available in Cluj-Napoca’s market, regarding their content in total phenolic compounds, total flavonoids and antioxidant capacity. The amount of total phenolic compounds from the investigated medicinal plant was quantified using the Folin-Ciocalteu method, while for determination of the total flavonoids, colorimetric assay with aluminum chloride was performed. Antioxidant activity of selected herbs was determined with 1,1-diphenyl-2-picrylhydrazyl (DPPH) reagent. The total phenolic content was between 2583.93 and 3662.26 mg GAE/100g, while the flavonoids concentration ranged between 1207.12 and 1423.4 mg QE/100g dry plant. It was found that the lemon balm and mint extracts showed the strongest antioxidant capacity, while sage is less active, these results being positively correlated with the concentration of phenolic compounds.

Keywords: antioxidant capacity, flavonoids, lemon balm, mint, phenolic compounds, sage.

Introduction. Medicinal plants have always been considered as a source of health. The Lamiaceae family includes a large number of plants that are well-known for their antioxidant properties (Capecka et al., 2005). Lemon balm (Melissa officinalis), mint (Mentha piperita) and sage (Salvia officinalis) are representative for the Lamiaceae family. These plants were reported to have a strong antioxidant activity due to their high amounts in natural antioxidant compounds (polyphenols and flavonoids) (Attanasova et al., 2011; Nickavar et al., 2007).

Aims. The aim of the present study was to characterize several medicinal plants (lemon balm, mint and sage), commercially available in Cluj-Napoca’s market, regarding their content in total phenolic compounds, flavonoids and antioxidant capacity.

Materials and Methods. The analysed samples were purchased from local supermarkets (Cluj-Napoca, Romania). All the samples were available in packs of 50 g. Briefly, 0.5 g of each sample was extracted with 50 ml of 80% aqueous methanol in an ultrasonic bath for 20 min. Then, the extract was centrifuged for 5 min at 4000 rpm. The total phenolic content in plant extracts was determined with the Folin-Ciocalteu assay. An aliquot of 0.1 mL of extract was mixed with 6 mL of water and 0.5 mL of Folin-Ciocalteu reagent. After 4 min, 1.5 mL of Na₂CO₃ solution (7.5%) was added and the sample was brought to final volume of 10 mL with water. After 120 min at room temperature, the absorbance was measured at 750 nm using a UV spectrophotometer. The total phenolic content was quantified from the calibration curve obtained from measuring the absorbances of a set of gallic acid standard solutions. Results were expressed...
as milligrams of gallic acid equivalents (GAE) per 100 g sample. The total flavonoid content was measured according to Atanassova et al. (2011). An aliquot of 1 ml extract was accurately removed in a volumetric flask, containing 4 ml of distilled deionized water and mixed with 0.3 ml of NaNO₂ (5%) solution. After 6 min, 0.3 ml of the Al(NO₃)₃ (10%) solution was added, shaken and left to stand for another 6 minutes. Finally, 2.0 ml of NaOH (4.3%) solution were added into the volumetric flask, followed by the addition of water to the final volume of 10 ml, shaken and allowed to stand for 30 min at room temperature, before measuring the absorbance at 500 nm; as reference was used the sample solution without coloration. A calibration curve was performed using different concentrations of standard quercetin solutions in order to quantify the total flavonoid content of each sample. The antioxidant activity of selected plants was assessed through the evaluation of free radical scavenging effect on 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical (Odriozola-Serrano et al., 2008). Using a Shimadzu UV-1700 PharmaSpec spectrophotometer, the absorbance of samples was measured at 515 nm. Results were expressed as the percentage decrease of the absorption value of samples comparing with the reference DPPH solution.

Results and Discussion. The highest concentration in phenolic compounds was determined for lemon balm (3662.26 mg GAE/100g), followed by the mint sample (3041.71 mg GAE/100g) and sage (2583.93 mg GAE/100g). The lemon balm also has the highest content in flavonoids (1423.4 mg QE/100g), followed by mint (1290.34 mg QE/100g) and sage (1207.12 mg QE/100g). Measurements of antioxidant activity of plant extracts showed a significant variation between them. Species with low phenolic contents exhibited relatively low antioxidant activity. The high content in total phenolic of lemon balm sample seems to have a decisive impact on its antioxidant activity (43.28%). Also, the mint sample presented the second antioxidant capacity (38.52%), followed by sage (35.90%).

Conclusion. The medicinal plants investigated presented a strong antioxidant activity due to the contribution of phenolic compounds. In conclusion, the present study showed that these medicinal herbs, widespread in Romania, have a strong antiradical activity and can be considered as a good source of natural antioxidants, useful for human health but also for other medicinal and commercial uses.

References
4. Odriozola-Serrano I., Soliva-Fortuny R., Martin-Belloso O., 2008, Effect of minimal processing on bioactive compounds and color attributes of fresh-cut tomatoes, LWT 41:217-226