



The influence of the extraction conditions on the quality of extracts of common plantain (*Plantago major* L.)

INTRODUCTION

Plants of the genus *Plantago* (plantain) have been used as medicinal plants for over four thousand years. One of the most common species of this genus in Poland is common plantain (*Plantago major* L.). Its leaves are used in folk medicine for the treatment of gastrointestinal disorders and for wound healing.

In the present study the usefulness of herb and underground organs of common plantain as a source of phenolic compounds was evaluated and the influence of extraction conditions on the effectiveness of isolation of these compound was determined.

RESULTS

Table 1. Technological performance herb extraction (%)

Raw material/ Solvent	Soxhlet				Under reflux				Ultrasound-assisted				Mean for solvent				Mean for raw material/solvent
	Water	EtOH 40%	EtOH 70%	EtOH 100%	Water	EtOH 40%	EtOH 70%	EtOH 100%	Water	EtOH 40%	EtOH 70%	EtOH 100%	Water	EtOH 40%	EtOH 70%	EtOH 100%	
1:10	16.5	32.7	26.9	16.8	5.0	11.9	12.8	9.1	8.8	9.2	14.9	9.0	10.1	17.9	4.8	11.6	14.5 B
1:20	32.3	35.6	22.2	22.9	16.7	20.3	19.9	12.8	16.2	19.0	10.7	6.3	21.7	30.0	20.5	14.0	19.6 A
Mean	24.4b	34.2a	24.6b	19.8c	10.8a	16.1a	16.4a	10.9a	12.5b	14.1a	12.8b	7.7c	15.9	21.5	17.9	14.5	
Mean for extraction	25.7 A				13.6 B				11.8C								

Table 2. Content of poliphenolic acids in herb (mg·100 g s.m⁻¹)

Raw material/ Solvent	Soxhlet				Under reflux				Ultrasound-assisted				Mean for solvent				Mean for raw material/solvent
	Water	EtOH 40%	EtOH 70%	EtOH 100%	Water	EtOH 40%	EtOH 70%	EtOH 100%	Water	EtOH 40%	EtOH 70%	EtOH 100%	Water	EtOH 40%	EtOH 70%	EtOH 100%	
1:10	16.5	32.7	26.9	16.8	5.0	11.9	12.8	9.1	8.8	9.2	14.9	9.0	10.1	17.9	4.8	11.6	14.5 B
1:20	32.3	35.6	22.2	22.9	16.7	20.3	19.9	12.8	16.2	19.0	10.7	6.3	21.7	30.0	20.5	14.0	19.6 A
Mean	24.4b	34.2a	24.6b	19.8c	10.8a	16.1a	16.4a	10.9a	12.5b	14.1a	12.8b	7.7c	15.9	21.5	17.9	14.5	
Mean for extraction	25.7 A				13.6 B				11.8C								

Table 3. Content of flavonoids in herb (mg·100 g s.m⁻¹)

Raw material/ Solvent	Soxhlet				Under reflux				Ultrasound-assisted				Mean for solvent				Mean for raw material/solvent
	Water	EtOH 40%	EtOH 70%	EtOH 100%	Water	EtOH 40%	EtOH 70%	EtOH 100%	Water	EtOH 40%	EtOH 70%	EtOH 100%	Water	EtOH 40%	EtOH 70%	EtOH 100%	
1:10	0.35	0.57	0.83	1.55	0.37	0.64	0.95	4.61	0.17	0.73	1.61	10.25	0.30	0.65	1.13	5.47	1.89 B
1:20	0.57	1.59	1.06	2.40	0.32	0.55	1.05	8.97	0.12	0.73	1.44	8.24	0.34	0.96	0.89	6.54	2.25 A
Mean	0.46c	1.08b	0.95bc	1.98a	0.35d	0.60c	1.00b	6.79a	0.15d	0.73c	1.53b	9.25a	0.32	0.81	1.01	6.00	
Mean for extraction	1.12 C				2.18 B				2.91 A								

CONCLUSION

1. The highest technological efficiency was characteristic for the Soxhlet-type extraction with ethanol 40% and 1:20 raw material to solvent ratio.
2. Phenolic acids were extracted most efficiently with the same method but with ethanol 70% used as a solvent, whereas flavonoids were better extracted with ethanol 100%.



Plantago major L.