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The effect of the method and duration of extraction on the content of biologically active compounds in herbal teas

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Abstract. The extraction of some most important biologically active compound classes and constituents (water-soluble extractive, polyphenols, tannins, flavonoids, coumarins, anthraquinones, hypercin, pigments, and saponins) into herbal teas, depending on the method and duration of the extraction, was studied. Five herbal teas were prepared of each crude drug studied (n = 11). Most constituents extract in the same amount in infusions and decoctions. The best results were achieved from the extraction during 12 h in a Thermos bottle.

Key words: herbal teas, infusion, decoction, extraction, biologically active compounds.

INTRODUCTION

Crude drugs are used for preparing herbal teas at home. Earlier, infusions and decoctions were also prepared in pharmacies according to the pharmacopoeia standards. By the Soviet Pharmacopoeia the extraction time of infusions is 15 min and for decoctions 30 min. Decoctions were cooled for 10 min and infusions for at least 45 min [1]. In a very popular book *Health Through God's Pharmacy* by German housewife Maria Treben it is recommended that the drug should be poured over with boiling water and allowed to stand only for 10–30 s before straining [2]. More academic publications recommend a longer extraction time. According to Weiss & Fintelmann the herbs should be allowed to steep for 5–10 or 10–15 min [3]. The literature written in the Russian language is in most

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cases influenced by the Soviet pharmacopoeias and recommends a longer extraction time for preparing infusions (45–60 min) [4]. It is rather often recommended that herbal teas be prepared in a Thermos bottle [2, 4, 5].

The purpose of the present work was to study the extraction of some major biologically active compound classes and constituents into herbal teas, depending on the method and duration of the extraction.

MATERIALS AND METHODS

As the research material, the following crude drugs were used: *Crataegi fructus* (hawthorn berries, *Crataegus monogyna* Jacq. em. Lindm.), *Valerianae radix* (valerian roots, *Valeriana officinalis* L.), *Uvae-ursi folia* (bearberry leaves, *Arctostaphylos uva-ursi* (L.) Spreng.), *Hyperici herba* (St.-John's-wort herbs, *Hypericum perforatum* L.), *Quercus cortex* (oak bark, *Quercus robur* L.), *Calendulae flos* (marigold flowers, *Calendula officinalis* L.), *Matricariae flos* (pineapple weed flowers, *Chamomilla suaveolens* (Pursh) Rydb.), *Chamomillae flos* (wild chamomile flowers, *Chamomilla recutita* (L.) Rauschert), *Frangulae cortex* (alder buckthorn bark, *Rhamnus frangula* L.), *Primula radix* (primrose roots, *Primula veris* L.), *Liquiritiae radix* (liquorice roots, *Glycyrrhiza glabra* L.).

Five herbal teas were prepared of each crude drug studied ($n = 11$). One tablespoonful of cut crude drug was poured over with 200 mL of water. The teas were prepared using five different methods: (1) it was left with boiling water for 10 min at room temperature, (2) it was left with boiling water for 3 h at room temperature, (3) an infusion was prepared, (4) a decoction was prepared (methods (3) and (4) following the Soviet Pharmacopoeia [1]), and (5) it was left with boiling water in a Thermos bottle for 12 h.

The content of water-soluble extractive and tannins was analysed applying the methods suggested in [1]. The amounts of polyphenols ($\lambda = 730$ nm), flavonoids ($\lambda = 428$ nm), coumarins ($\lambda = 315$ nm), anthraquinones ($\lambda = 540$ nm), hypericin ($\lambda = 425$ nm), and pigments (carotenoids, $\lambda = 455$ nm) in herbal teas were determined spectrophotometrically. The foaming index of saponins was analysed according to the *International Pharmacopoeia* [6]. The content of biologically active compounds (Table 1) was calculated to the dried herbal substance. The standard errors were mostly calculated to four parallel measures of optical density, or four parallel extractions for water-soluble extractive and to four parallel shakings of herbal teas for the determination of the foaming index.

RESULTS

The least water-soluble extractives were received from the 10 min extraction of crude drugs (Table 1). There was also the smallest amount of polyphenols and

Table 1. The content of biologically active compounds in selected herbal teas depending on the method and duration of extraction

Herbal substance	10 min	3 h	Infusion	Decoction	12 h in Thermos bottle
			Water-soluble extractive, %		
Crataegi fructus	28.3 ± 1.8	35.8 ± 1.7	39.3 ± 1.9	36.6 ± 1.3	36.4 ± 1.7
Valerianae radix	10.9 ± 0.6	23.3 ± 1.4	21.0 ± 1.3	23.9 ± 1.7	30.0 ± 1.9
			Polyphenols, %		
Uvae-ursi folium	19.6 ± 0.15	23.0 ± 0.25	22.1 ± 0.65	22.5 ± 0.23	25.3 ± 0.19
Hyperici herba	19.3 ± 0.52	23.2 ± 0.20	20.7 ± 0.06	20.5 ± 0.16	26.3 ± 0.12
			Tannins, %		
Uvae-ursi folium	10.1 ± 0.13	16.4 ± 0.22	18.9 ± 0.25	19.7 ± 0.74	24.5 ± 0.15
Quercus cortex	7.9 ± 0.12	8.8 ± 0.32	9.3 ± 0.43	11.3 ± 0.25	15.1 ± 0.21
			Flavonoids, mg%		
Crataegi fructus	162.4 ± 0.89	201.4 ± 1.61	228.7 ± 1.15	248.7 ± 0.28	272.9 ± 1.05
Calendulae flos	112.3 ± 0.82	158.7 ± 1.93	186.6 ± 2.40	184.3 ± 0.18	223.8 ± 0.63
			Coumarins, mg%		
Matricariae flos	164.3 ± 1.03	163.8 ± 0.56	207.7 ± 0.68	300.2 ± 1.43	216.2 ± 0.42
Chamomillae flos	184.2 ± 0.56	462.3 ± 1.15	406.1 ± 0.94	510.1 ± 0.38	268.9 ± 0.67
			Anthraquinones, mg%		
Frangulae cortex	281.0 ± 7.43	359.0 ± 4.31	271.4 ± 35.56	317.6 ± 2.88	388.0 ± 5.49
Hyperici herba	1414.3 ± 33.65	2048.3 ± 8.10	2366.7 ± 18.68	2474.1 ± 18.67	2811.9 ± 16.32
			Hypericin, mg%		
Hyperici herba	139.5 ± 8.93	323.7 ± 2.08	283.9 ± 2.81	425.0 ± 4.67	536.1 ± 5.76
			Pigments, mg%		
Calendulae flos	82.8 ± 0.58	124.3 ± 0.25	131.0 ± 1.58	139.2 ± 0.96	210.7 ± 0.50
			Saponins, foaming index		
Primulae radix	<100	153.9	173.0	200.0	285.7
Liquiritiae radix	<100	111.1	208.3	250.0	429.2

tannins in the teas that had stood for 10 min. The highest content of flavonoids was ensured by the 12 h extraction in a Thermos bottle. The content of coumarins in teas acted differently from the other constituents. The content of anthraquinones was equal in infusions and decoctions, but hypericine dissolves in water very slowly and more of it was found in decoctions than in infusions. Carotenoids extracted minimally during 10 min and maximally during 12 h. The extraction of saponins showed a similar tendency to the other constituent classes.

Our results showed that in most cases the extraction during 10 min ensured the smallest extraction of the constituents of crude drug into herbal teas. Extraction in a Thermos bottle during 12 h gave the best results.

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Ekstraktsiooni meetodi ja kestuse mõju bioloogiliselt aktiivsete ainete sisaldusele ravimtaimede vesitõmmistes

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On uuritud olulisemate toimeainegruppide ja koostisainete (ekstraktiivained, polüfenoolid, tanniinid, flavonoidid, kumariinid, antratseenid, hüperitsiin, karotenoidid ja saponiinid) ekstraheeruvust vesitõmmistesse sõltuvalt ekstraktsiooni meetodist ja kestusest. Uuritavatest droogidest (n = 11) on valmistatud viis erinevat vesitõmmist. Enamik analüüsitud koostisainetest ekstraheerub leotistesse ja keedistesse võrdsel määral. Ekstraktsiooni korral saadakse parimad tulemused 12 tunni jooksul termoses.