Effects of Drugs of Plant Origin on the Development of the Immune Response

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The effects of extracts from licorice (*Glycyrrhisa glabra*), great nettle (*Urtica dioica*), common burdock (*Arctium lappa*), and bur marigold (*Bidens tripartite*) on the humoral and cellular immune response and nonspecific resistance in mice were studied. Burdock and bur marigold extracts stimulated the humoral immune response, nettle and licorice extracts stimulated cellular response and nonspecific resistance, their effects being superior to those of pharmacopoeial *Echinacea purpurea* tincture.

Key Words: *plant extracts; mice; immune response*

Side effects of technological progress (environmental pollution, household chemicals, ecologically unwholesome foodstuffs) can promote the development of immune dyscoordination. According to the data of the Russian Academy of Medical Sciences, 40% adult population of Russia suffers from immune system disorders, this, in turn, leading to an increase in disease incidence. Wide use of synthetic immunostimulatory drugs is often impossible because of their side effects. Immunotropic drugs of plant origin have many advantages: mild pharmacological activity, low toxicity, and the possibility of modulating different components of the pathological process due to variety of bioactive substances present in the plants [1].

We attempted to extend the range of immunostimulatory drugs of plant origin.

MATERIALS AND METHODS

Experiments were carried out on 8-12-week-old male CBA/CaLac mice (n=90; 18-20 g), first-category certified animals (conventional inbred mice) obtained from Breeding Center of Institute of Pharmacology. The animals were kept on standard fodder in plastic cages, 10 per cage, for 1 week before the study.

Extracts from great nettle (*Urtica dioica*), common burdock (*Arctium lappa*), bur marigold (*Bidens*), and licorice (*Glycyrrhiza*) were prepared by repercolation using 40% ethanol in 1:1 proportion. The extracts were standardized by ethanol and dry residue content [2,3]. The preparations were administered to experimental animals through a gastric tube for 5 days in a dose of 50 mg/kg in 0.2 ml distilled water. *Echinacea purpurea* infusion (GalenoPharm; allowed for use in Russia, Reg. No. 000167.01-2000) in the same dose served as the reference drug. Controls received the same volume of the solvent. In order to evaluate the humoral immune response, the animals were immunized with corpuscular thymus-dependent antigen, sheep erythrocytes (EKOlab) in a single intraperitoneal dose of 0.2 ml 15% erythrocyte suspension on the last day of drug treatment. The material was collected on days 4 and 7 after immunization. The mice were decapitated under ether narcosis. Splenic antibody-producing cells (APC) were evaluated by local hemolysis [6], serum specific IgG and IgM by hemagglutination test [4]. Nonspecific resistance was evaluated by the peripheral blood neutrophil phagocytic activity in the latex absorption test (melamine formaldehyde latex particles, 1.5-2.0 μ; Institute of Biological Engine-

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ering, Moscow) on days 4 and 7 after treatment. The percentage of phagocytic cells (phagocytic index, PI) and number of latex particles absorbed by each cell (phagocytic number, PN) were evaluated [5]. Drug effects on delayed-type hypersensitivity (DTH) were evaluated as described previously [5].

The data were processed by methods of variation statistics using Statistica 5.0 software.

RESULTS

Course treatment with all the studied extracts led to stimulation of humoral immune response of different intensity to thymus-dependent antigen (Fig. 1). Burdock extract more actively promoted an increase in the total splenocyte count, percentage and count of APC (which led, in turn, to elevation of serum IgM) in com-

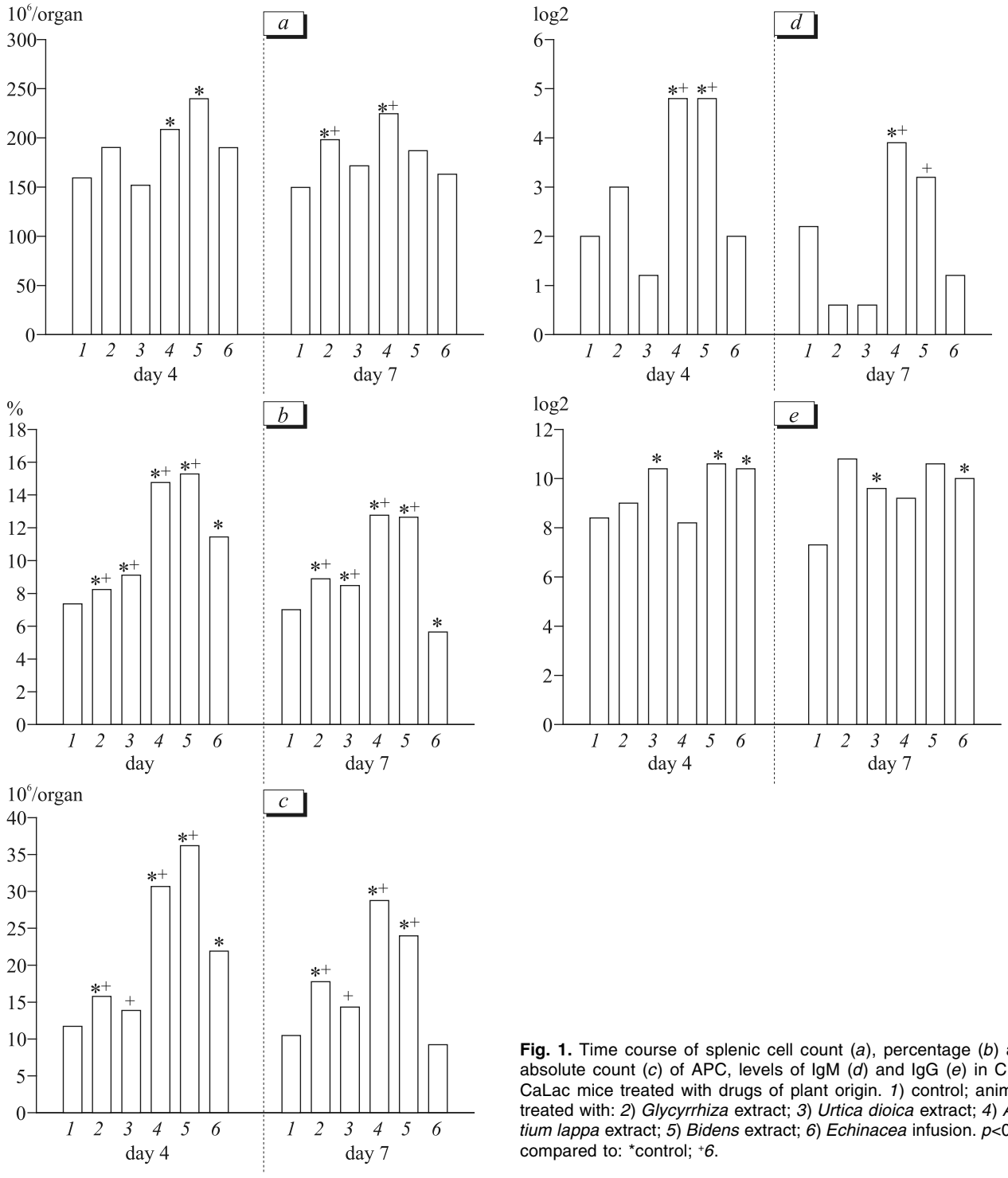

Fig. 1. Time course of splenic cell count (*a*), percentage (*b*) and absolute count (*c*) of APC, levels of IgM (*d*) and IgG (*e*) in CBA/CaLac mice treated with drugs of plant origin. *1*) control; animals treated with: *2*) *Glycyrrhiza* extract; *3*) *Urtica dioica* extract; *4*) *Arctium lappa* extract; *5*) *Bidens* extract; *6*) *Echinacea* infusion. $p<0.05$ compared to: *control; $^{+}$*6*.

TABLE 1. Effects of Extracts from Licorice (*Glycyrrhiza*), Great Nettle (*Urtica dioica*), Common Burdock (*Arctium lappa*), Bur Marigold (*Bidens*), and *Echinacea purpurea* Infusion on the Phagocytic Activity of Peripheral Blood Neutrophils of CBA/CaLac Mice ($X \pm m$)

Group	Day after treatment			
	4		7	
	PI, %	PN	PI, %	PN
Control	22.00±1.22	2.06±0.23	17.25±1.80	3.79±0.62
Licorice extract	24.5±2.9	4.63±0.37*	26.60±0.75	2.78±0.31
Great nettle extract	41.80±3.81*	7.46±0.74*+	26.00±3.45	2.32±0.15
Common burdock extract	28.50±3.12	6.64±0.08*+	21.60±0.98	4.93±0.31
Bur marigold extract	17.75±0.75*+	6.18±0.35*+	11.80±1.32*+	5.89±0.57*
Echinacea infusion	32.00±3.91*	4.72±0.45*	23.80±2.13	4.52±0.23

Note. Here and in Table 2: $p<0.05$ compared to: *control, +reference group.

parison with the control during all periods of the study. Its stimulatory effect on this component of immunity was higher than that of the reference drug by all parameters except the IgG titer. Treatment of animals with bur marigold extract also stimulated the response to immunization (in comparison with the control and with the reference group) on day 4 of experiment. By day 7, the differences remained significant only for the level of antibody-producing cells in the spleen. The effects of great nettle and licorice extracts on the levels of the studied parameters were less manifest, consisting largely in stimulation of APC proliferation, rather than stimulation of synthetic activity of these cells.

The data on phagocytic activity of neutrophils in mice treated with drugs of plant origin are summed up in Table 1.

Courses of nettle and licorice extracts before animal sensitization led to a significant increase of the inflammation index in DTH reaction (Table 2). That fact indicated their stimulatory effects on the formation of the clone of antigen-specific T-lymphocytes. Extracts from burdock and echinacea infusion did not change the reaction intensity, while the extract from bur marigold reduced the level of this parameter 1.5 times, presumably due to its anti-inflammatory activity.

Hence, extracts from burdock and bur marigold stimulated the humoral immune response, extracts from nettle and licorice stimulated the cellular immune response and nonspecific resistance, their effects being higher than those of pharmacopoeial *Echinacea purpurea* tincture.

TABLE 2. Effects of Extracts from Licorice (*Glycyrrhiza*), Great Nettle (*Urtica dioica*), Common Burdock (*Arctium lappa*), Bur Marigold (*Bidens*), and *Echinacea purpurea* Infusion on DTH Reaction in CBA/CaLac Mice ($X \pm m$)

Group	Inflammation index, %
Control	18.05±1.04
Licorice extract	23.99±1.56*
Great nettle extract	27.33±1.45*+
Common burdock extract	17.74±1.31
Bur marigold extract	12.16±1.57*+
Echinacea infusion	18.53±1.96

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