PHARMACOLOGY AND TOXICOLOGY

Effects of Siberian Ginseng Extract and Ipriflavone on the Development of Glucocorticoid-Induced Osteoporosis

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Siberian ginseng extract produced a protective effect during experimental steroid-induced osteoporosis, which was comparable with the influence of ipriflavone.

Key Words: *osteoporosis; glucocorticoids; Siberian ginseng; ipriflavone*

The search for new potent drugs for the therapy and prevention of osteoporosis is an urgent medical problem [1,7]. The development of osteoporosis is related to long-term treatment with systemic glucocorticoids that are widely used for the therapy of various diseases [6]. Preparations of calcium, vitamin D, calcitonin, biphosphonates, and ipriflavone are used for the therapy and prevention of steroid-induced osteoporosis [10]. Published data suggest that adaptogens can improve the course of osteoporosis [10]. Siberian ginseng (*Eleutherococcus senticosus*) extract serves as a universal regulator of various functions. It accelerates readaptation after long-term hypokinesia that promotes the development of osteoporosis, possesses nonspecific anabolic properties, promotes reparative processes, and corrects endocrine disturbances in females with postclimacteric osteoporosis [3,4].

Here we studied the ability of liquid extract from Siberian ginseng (LESG) to prevent bone resorption during experimental steroid-induced osteoporosis. Clinical and experimental studies proved high efficiency of ipriflavone in the therapy of osteoporosis [11]. This preparation was used as a reference drug.

MATERIALS AND METHODS

Experiments were performed on 86 male Wistar rats weighing 120-160 g. Group 1 animals were intact. Steroid-mediated osteoporosis in rats of groups 2, 3, and 4 was produced by the method of L. E. Ziganshina *et al*. [5]. The animals received prednisolone in a daily dose of 5 mg/kg for 30 days (through a gastric gube) [5]. Group 2 rats served as the control. Group 3 and 4 animals received dealcoholized LESG (1 ml/kg/day) and ipriflavone (10 mg/kg/day, Osteochin, Chinoin), respectively simultaneously with prednisolone. Urinary excretion of calcium, phosphorus, and hydroxyproline and plasma levels of calcium and phosphorus were measured on days 10, 20, and 30. Calcium and phosphorus concentrations were estimated spectrophotometrically using Calcium-Novo and Phosphorus-Novo kits [2]. Hydroxyproline concentration was determined by the method described elsewhere [2]. The rats were decapitated under light ether anesthesia on day 30. The femur and lumbar vertebrae were isolated. Breaking strength was estimated routinely at the Laboratory of Material Resistance (Far-Eastern Polytechnic University) [8].

The results were analyzed by Student's *t* test.

RESULTS

On day 10 urinary excretion of calcium and hydroxyproline in control rats increased by 3 and 1.7 times, respectively, compared to intact animals. In control rats urine phosphorus concentration increased on day 20 (Fig. 1). Plasma levels of calcium and phosphorus in control rats significantly increased on day 20 (Fig. 2).

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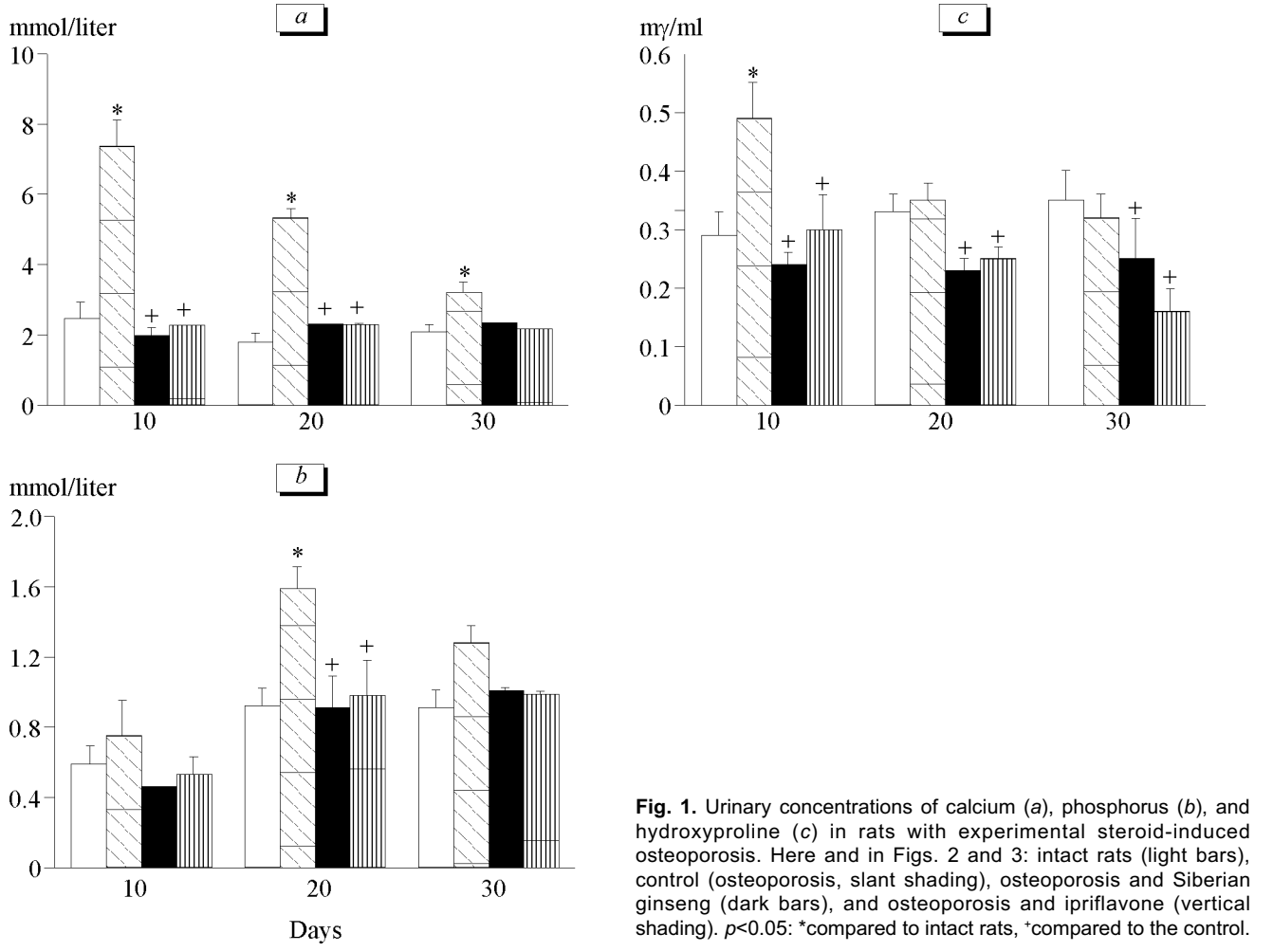

Fig. 1. Urinary concentrations of calcium (*a*), phosphorus (*b*), and hydroxyproline (*c*) in rats with experimental steroid-induced osteoporosis. Here and in Figs. 2 and 3: intact rats (light bars), control (osteoporosis, slant shading), osteoporosis and Siberian ginseng (dark bars), and osteoporosis and ipriflavone (vertical shading). $p<0.05$: *compared to intact rats, +compared to the control.

In rats receiving LESG for 10-30 days urinary excretion of calcium and hydroxyproline decreased by 3.7-1.4 times and 51-18%, respectively, compared to the control ($p<0.05$, Fig. 1). On days 10-30 of ipriflavone treatment urinary excretion of calcium and hydroxyproline decreased by 3.2-1.5 times and by 39-50%, respectively, compared to the control ($p<0.05$, Fig. 1).

LESG normalized plasma concentrations of calcium and phosphorus in rats with experimental steroid-induced osteoporosis (Fig. 2).

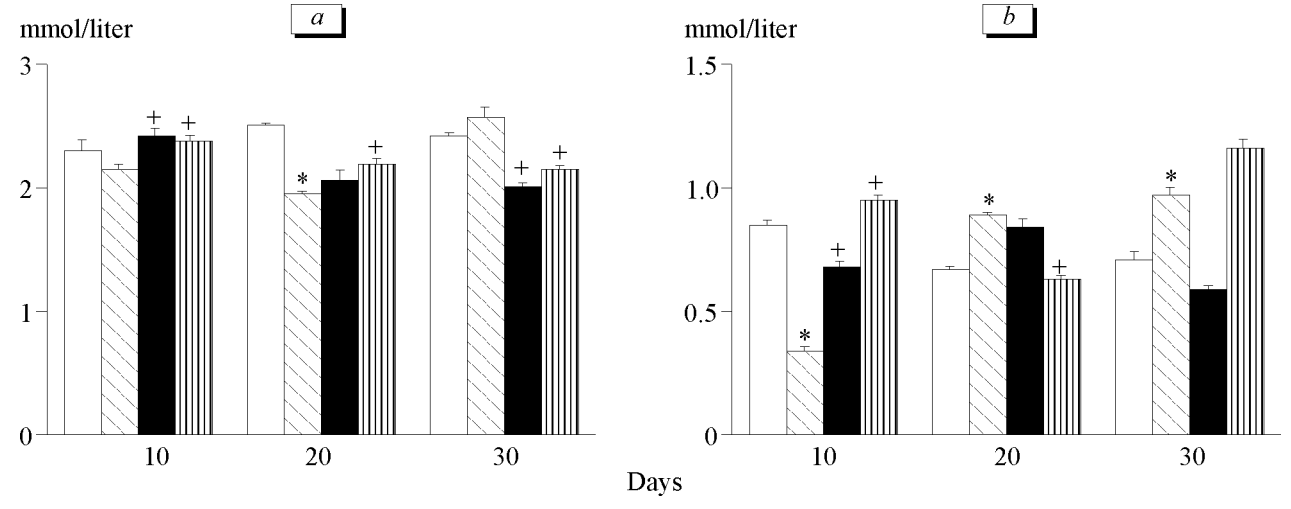

Fig. 2. Plasma levels of calcium (*a*) and phosphorus (*b*) in rats with experimental steroid-induced osteoporosis.

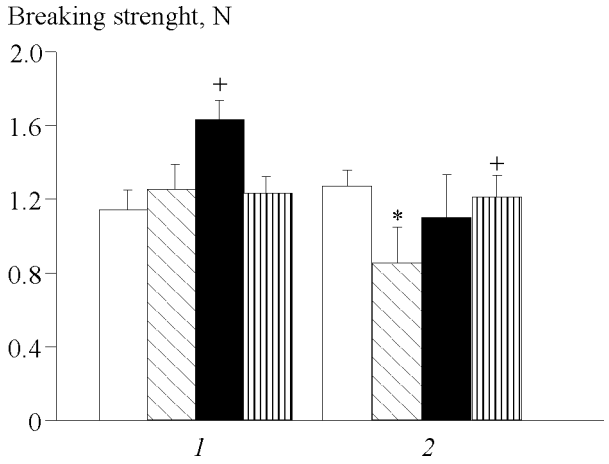

Fig. 3. Breaking strength of the femur (*1*) and vertebrae (*2*) in rats with experimental steroid-induced osteoporosis on day 30.

In control animals breaking strength remained unchanged in femoral diaphyses, but decreased by 33% in vertebrae (day 30, $p<0.05$, Fig. 3). In rats receiving LESG breaking strength of femoral diaphyses and vertebrae increased by 42.3 and 29.4% (insignificant), respectively, compared to the control. In rats receiving ipriflavone breaking strength did not change in the femur, but increased by 42.3% in lumbar vertebrae (Fig. 3).

Our results indicate that during steroid-induced osteoporosis the preventive effect of LESG is comparable with that of ipriflavone.

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