USE OF BONE TISSUE OF CATTLE FOR PRODUCTION OF THE MEDICAL PREPARATION

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Introduction

The disorder of mineral metabolism in human organism is a result of washing out of calcium from bone tissue that leads to osteoporosis of different etiology. A new medical preparation "Calfocol" from the bone tissue of cattle in the form of encapsulated tablets for the regulation of calcium-phosphorus metabolism in human organism has been developed at VNIIMP. As distinct from synthetic compositions, the bone tissue of slaughter animals contains the optimum ratio of calcium and phosphorus, which is most favorable for human organism. The confirmation is the composition of inorganic part of the bone tissue containing not less than 25% of calcium and 9% of phosphorus . Along with mineral salts it contains not less than 39% of collagen, called as ossein, and also proteoglycan. To confirm a specific pharmacological action of the preparation it is important to study its influence on biochemical indices characterizing the state of calcium-phosphorus metabolism on experimental animals.

The objective of the work is the development of a new medical preparation from bone tissue of slaughter animals for regulation of calcium-phosphorus metabolism in human organism, study of its effectiveness and safety on model animals.

Experimental methods

To solve the posed problem there were determined the content of calcium and phosphorus, alkaline phosphatase in blood serum, levels of calcium and phosphorus in the bone tissue, levels of oxyproline in rats urine. The osteoporosis-like state of the animals was created by keeping them at special D-avitaminosis diet. The animals were divided into 5 groups, 21 to each: 1 - rats kept at a standard diet of the vivarium during 45 days of the experiment and designated as "intact"; 2 – rats kept at D-avitaminosis diet during the whole experimental period and not receiving the preparation - the control; 3 – rats that were kept at D-avitaminosis diet during the whole experimental period and receiving Calfocol preparation at 25mg/kg daily beginning from the 15th day of the experiment; 4 – rats being at D-avitaminosis diet during the whole experimental period and having Calfocol preparation at 50mg/kg daily beginning from the 15th day of the experiment; 5 – rats being at D-avitaminosis diet during the whole experimental period and receiving from the 15th day the preparation "Osteogenon" (Pierre-Fabre company, France) for comparison purposes. The preparations were administered perorally as a water suspension. Blood, urine and bone tissue were taken after slaughter of the animals on 14, 30 and 45 days of the experiment, daily urine on the specified days was collected from the animals placed in metabolic cages.

Table 1

Time (days)	Groups	Biochemical indices in blood serum		
		Activity of alkaline phosphatase, U/L/min	Calcium content, n mol/ml	Phosphorus content n mol/ml
14 days (n=7)	Intact	243.9± 20.5	1.67 ±0.09	642.9 ±43.9
	Control	320.7±17.76	2.14± 0.09 b	936.5±70.5 b
	Calfocol-25	351.9 ±21.1b	2.03±0.11 b	914.0±64.8 b
	Calfocol-50	340.5±12.5b	2.38±0.12 b	1184.7±196.4 b
	Osteogenon-50	356.0±7.5 b c	2.41 ± 0.14 b	1091.5 ± 109.51 b
30 days (n=7)	Intact	326.7± 17.6 a	1.77± 0.10	681.2± 23.6
	Control	389.6±26.0 a	2.27±0.15	764.4± 58.3
	Calfocol-25	389.8± 20.7	1.78±0.09 c	457.1±36.1 a b c
	Calfocol 50	463.6±23 a b c	2.29±0.16 b	509.4 ± 20.9 a b c
	Osteogenon-50	481.2 ±30.3 a b c	2.54 ±0.14 b	515.9± 22.3 a b c
45 days (n=7)	Intact	330.7± 31.6 a	1.86± 0.09	666.2 ± 59.5
	Control	475± 24.5 a b c d	2.59± 0.11 a b	813.5± 33.5
	Calfocol-25	385.8± 15.2c	1.75 ± 0.12 c	802.9 ±64.9 d
	Calfocol-50	437.7 ±28.2 d a b	1.44 ± 0.09 a b c d	886.2 ± 24.2 b d
	Osteogenon 50	435.9± 30.4 b	1.51 ± 0.08 a b c	925.1 ± 3.52 b c d

Note: n = number of animals; a,d,b,c - confident as compared to 14 and 30 days, intact and control animals, respectively

Table 2

Time (days)	Groups	Biochemical indices of bone tissue		Biochemical indices in urine	
		Calcium content, n mol/mg bone	Phosphorus content, n mol/mg bone	Oxyproline content, n mol/ml	Phosporus content, n mol/ml
14 days (n=7)	Intact	546.6±29.3	987.8±39.5	226.2±20.9	2667.9±453.7
	Control	474.7±26.1 b	877.2±27.9 b	275.9±59.9	3249.1±157.7
	Calfocol-25	454.1±17.7 b	853.3± 34.0 b	284.6±43.0	3516.1±130.9
	Calfocol-50	477.6±20.1 b	868.2±48.6 b	255.0±51.1	4918,3±596,7 b c
	Osteogenon-50	459.1±19.8 b	919.6 ±27.3	264.2±41.3	4828.5±424.7 b c
30 days (n=7)	Intact	547.9 ±63.3	937.5±27.7	292.2±24.2	4398.2±212.3
	Control	381.6±17.9 a b	736.4±34.5 a b	597.1±31.1 a b	7381.3±629.6 a
	Calfocol-25	643.8±88.7 a c	1013.1±56.9 a c	534.2±81.1 a b	8834.7±900.7 a b
	Calfocol-50	574.8±34.8 a c	1014.7±37.1 a c	498.8±55.0 a b	8858.1±1247.1 a b
	Osteogenon-50	497.1±17.8 c	1108.2±47.2 a b c	526.8± 37.5 a b	8961.1±759.3 a b
45 days (n=7)	Intact	542.5 ±13.8	991.8±28.1	192.3±21.8 d	3661.7±110.8
	Control	340.4±18.9 a b	795.8±42.5 b	591.5±15.2 a b	10512.5±792.8 a b d
	Calfocol-25	612.6±41.1 a c	951.6±40.7 c	346.9±33.7 b c d	8936.4 ±1046.2 a b
	Calfocol -50	529.2±23.9 c	997.6±43.1 a c	366.9 ±22.8 b c d	8274.9±863.3 a b
	Osteogenon-50	467.0±29.4 b c	904.2±44.2 c	406.6±15.0 b c d	8398.4±1111.2 a b

Note: all designations as in Table 1

Results

Table I shows results of study of the influence of "Calfacol" and "Osteogenon" preparations on biochemical indices in blood serum, characterizing the state of calcium-phosphorus metabolism in animals.

Table 2 shows results of the influence of Calfocol and Osteogenon preparations on biochemical indices in bone tissue and urine, characterizing the state of calcium-phosphorus metabolism in animals.

The data in Table 1 indicate an evident increase of the activity of the alkaline phosphatase in all groups of animals kept during 14 days on D-avitaminosis diet as compared to intact animals. Such increase in enzyme activity is one of the first and specific evidences of D-avitaminosis, followed by washing out of calcium from bones. The used diet induced an appreciable decrease of calcium content in the bones of rats in the control group as compared to the intact group on the 14th and 35th day of the experiment (Table 2). The increase in calcium level in the bone tissue of the animals receiving Calfocol and Osteogenon was observed after 30 days of the experiment. Increase in the level of oxyproline in the urine which is also one of characteristic features of calcium-phosphorus metabolism disorder was marked in the group of animals kept at the diet during 30 and 45 days of the experiment (Table 2).

Discussion

Generally, according to the main indices (Tables 1 and 2) the used diet led to the development of changes in calcium-phosphorus metabolism characteristic of osteoporosis and D-avitaminosis. On this changed background the normalizing effect of Calfocol and Osteogenon with regards to above-mentioned indices was distinct. Besides, as far as the most indices are concerned , the less of the used doses (25mg/g) proved more effective than the greater dose (50mg/kg).

When comparing the positive influence of Calfocol at both doses with the effect of Osteogenon at 50mg/kg on calcium level in blood and bone tissue of the animals one can note a little greater effect of the former of the above preparations.

Conclusion

The obtained results lead to the conclusion about a sufficient effectiveness of the studied preparation when treating osteoporosis-like states.

References

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