SERUM PROTEIN CHANGES IN RABBITS AFTER CHRONIC ADMINISTRATION OF LEAD AND CADMIUM

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ABSTRACT

The influence of lead (5mg/kg b.w) and cadmium (2mg/kg b.w) after chronic treatment of the rabbits on serum protein is investigated. Significantly raised content of the cholesterol, ASAT and ALAT; hypo-albuminemia and hyperbeta-globulinemia of the background of one hypoproteinemia and low A/G coefficient are established. On basis of obtained result can to show degree of liver parenchyma damage and as trial for used the hyperbeta-globulinemia (at chronic treatment with cadmium is stronger markedly) as indicator for delimitation of enteral from parenteral toxication, at that is noted hypergamma-globulinemia.

Key words: serum proteins, lead, cadmium, cholesterol, transpherase

РАЗШИРЕНО РЕЗЮМЕ

Тежките метали оказват негативно влияние върху растежа, продуктивността, обменните процеси и устойчивостта на животните, водят до хипертрофия на надбъбречните жлези като повишават и секрецията на кортикостероиди. В това отношение оловото и кадмият притежават подчертан инхибиращ ефект върху редица ензими като блокират сулфхидрилните им групи, разстройва се усвояването на свободните аминокиселини и синтезата на белтъчините, което в крайна сметка води до снижаване качеството и на животинските суровини и продукти, получени от хранени с тежки метали животни.

Като имахме пред вид, че промените в серумните белтъчини са ранен признак за токсични увреждания на черния дроб, ние си поставихме за цел да проучим неговото ниво и профил при хронично третирани зайци с олово и кадмий и го свържем със степента на увреждане на органа.

За извеждане на опитите използвахме 30 броя зайци от породата Белгийски великан, разделени на контролна и две опитни групи. Едната опитна група захранвахме ежедневно в продължение на 30 дни с 5% воден разтвор на оловен ацетат така, че приеманото количество олово за деня да бъде 7 mg/kg живо тегло, а втората група с 5% воден разтвор на кадмиев ацетат с дневна доза 2 mg/kg живо тегло. Кръв за изследване вземахме на 0, 15 и 30 ден от ушната вена.

Общият белтък определяхме по биоретовия метод, а белтъчните фракции чрез микроелектрофореза върху носител целогел при сила на тока 190 V за 20 min, оцветявахме с Amidoschwarz 10 B и отчитахме на интегриращ денситометър Carl Zeiss Jena. Количеството на холестерола и активността на аспартатаминотрансферазата / ACAT/ и аланинаминотрансферазата /ALAT/ определяхме с тестове на фирма Huma-lab, Multitract Bulgaria. Получените резултати обработихме по Стюдънт-Фишер.

Хроничното приемане на олово (5 mg/kg живо тегло дневно) и кадмий (2 mg/kg живо тегло дневно) от зайци води до увреждане на чернодробния паренхим, в резултат на което се наблюдава нарастване нивото на ASAT, ALAT и холестерола; развиват се хипоалбуминемия и хипербета-глобулинемия на фона на една обща хипопротеинемия и намален А/Г коефициент. Тези промени зависят от времето на въздействие на токсичния фактор като са по-подчертани при хронично отравяне с кадмий.

В диференциално диагностично отношение хипербета-глобулинемията може да бъде използвана като критерий за отдиференциране на ентералната от парентералната хронична токсикоза у животните.

INTRODUCTION

Anthropogenic factor with special ecological considerable for our country (Bulgaria) is the soils and forage contamination by heavy metals. Their possibility to fall with various levels into food chain lead to intensify the attention of the research-workers and the experimenters towards their determination, accumulation and control with view to protection of the human health.

Heavy metals show negative effects on growth, productivity, exchange process and stability of animals [16], lead to hypertrophy of adrenal glands and increase corticosteroids secretion [6,8]. In this respect lead and cadmium have marked inhibition effect on series enzymes as blocked sulphdril groups, disorganization of assimilation of the free amino acids and synthesis of the proteins, which lead in the final reckoning to reduce of the quality of animals raw and products [13].

Our researches [10,11,12,13] and others researches [15,22] prove, that the lead and cadmium have affinity towards the kidneys and liver. Attack sulphdril groups of the renal molecules and enzymes [17], inhibit the proteases [4] that caused disturbance of the proteins syntheses. Therefore the permanent stress of the increased contents of the lead and cadmium through the food lead to disturbance in the assimilation processes and proteins syntheses.

We have taken into consideration the serum proteins changes are the early symptom for the liver's toxic injury, we set the target to investigate its level and profile at chronic treatment of the rabbits by lead and cadmium and it joint up with the organs injury degree.

Material and methods

Thirty Belgian rabbits were included in the experiment. Rabbits were divided into control and tow experimental groups. In the experimental group 1, 5% of lead acetate was administered daily in the form water solution in continuation of 30 days, so that the accepting quantities lead for one day to be 7 mg/kg body weight. In the second experimental group, 5% cadmium acetate was administered daily in the form water solution with dose 2mg/kg body weight daily. Blood samples were taken from ear vein at 0, 15 and 30 day.

Total proteins determine according to bioretive method [2], protein fractions though the microelectropherase on the bearer celogel at 190 V electric forces for 20 min, stain with amidoschwarz 10 B and read to integral densitometer Carl Zeiss Jena. The quantity of the cholesterol and the activity of aspartataminotranspherase (ACAT) and alaninaminotranspherase (ALAT) were determined with

tests of the Huma-lab, multitract Bulgaria firm. The results were statistical analyzed using Student's t-test.

RESULTS AND DISCUSSION

The basic functions of the liver can to be in following directions: participation in the exchange of the sugars, fats, proteins, pigments and vitamins; it has excretion, bile generant, inoffensive, coagulation functions. For this at series of infectious, untainted and parasitic diseases, toxic and others conditions the liver can be attacked.

From dates of tables 1 and 2 were showed that the chronic lead and cadmium administration on the rabbits lead to importance changes in the liver activity and proteins profile of the blood. The role of liver is great exceptionally for supporting of the constantly level of the cholesterol in the organism [2], because it is not only it excrete through gall, but so it accumulate in the it cells after etherification.

The detection of enhanced concentration of enzymes cells liver in the serum blood is indication for damage of the liver's parenchyma [9]. In this sense, high concentrations of ASAT and ALAT in serum blood in our research, show toxic effects of the tow elements. According [2], at chronic liver damage, concentration of ASAT even is higher than ALAT in result of the release of isoenzyms from the mitochondria. Raised activity of the enzymes follow to examined no only as result of their release from necrosis of the cell's liver in the blood, but so as result from break of the proportion between their synthesis process and their secretion from liver in the result of the changes in the permeability of cell's membranes.

The lead and cadmium ions are showed marked affinity toward the sulphdril groups of the number enzymes as them inhibit [4,5,7]. Under influence of the chronic load of the toxic elements, proteins assimilation is disorganized. For this detection in our research connected with damages in the liver profile, we associate with the created of metabolism tension in the organism, that lead to disturbance in the nitrogen balance and level of molecules [17]. Connected with toxic effect of the tow elements too found high concentration of methionin in the blood, as well as low it concentration in the meat [13] that are results of the active detoxication processes flow in the liver.

The dates in the table 2 are showed, that the general proteins and albumen decrease with increase the time of influence of the toxic elements and the degree of the capillary wall damage. While decrease of general serum proteins is 10-12%, decrease of the albumen is 24-60%, as so it is stronger markedly after treatment of the rabbits with cadmium. Independently, that another author indicate

Table 1. Level of cholesterol, ASAT and ALAT in the blood of rabbits, chronic treatment with lead (5mg/kg) and cadmium (2mg/kg body weight)

Index	control	I experimental 5mg pb/kg b.w	II experimental 2mg Cd/kg b.w
Cholesterol, mmol/l	7.5±1.1	10.2±1.5	11.8±1.7
ASAT, U/l	10.8±1.8	18.4±1.1	20.2±0.94
ALAT, U/l	16.4±1.6	30.3±2.2	31.5±1.9

Table 2. Level of the general serum protein and protein profile of rabbits at chronic treatment with lead (5mg/kg b.w) and cadmium (2mg/kg b.w)

Group	Day of the examination	General protein, g/l	Albumen %	Globulin			A/G
				alpha	beta	gamma	
Control	0	70.6±0.33	54±2.2	12	13	25	1.08
	15	71.8±0.29	55±1.8	11	12	27	1.08
	30	70.9±0.22	54±2.4	11	14	25	1.08
I experimental	0	70.2±0.24	54±2.3	12	13	25	1.08
	15	65±0.35	48±2.8	10	18	27	0.87
	30	63.3±0.31	41±1.6	8	20	29	0.72
II experimental	0	70.4±0.28	55±1.9	12	13	25	1.1
	15	64.2±0.21	27±2.1	12	26	27	0.42
	30	62±0.34	22±2.3	12	36	28	0.30
Standard *		70 - 75	55 - 65	8 - 12	7-13	17-23	

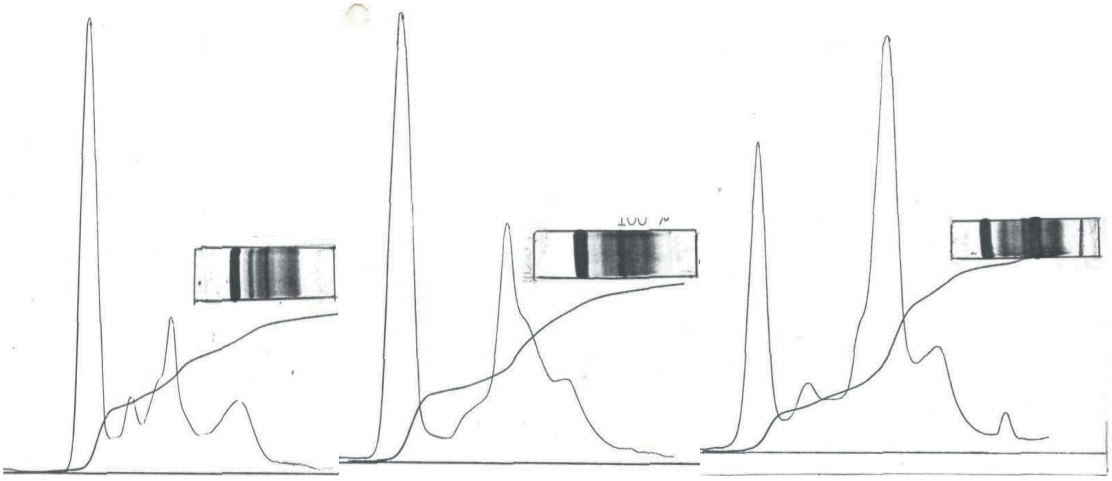

Figure 1. denzitograms of serums from healthy /A/ and chronic treatment of the rabbit with lead (B) and with cadmium (C)

raised of the alpha-globulin fractions at toxic damage of the liver [21], at our research determine strong raised of the beta-globulins (form 2 to 3 hold/ figure1.B). Unison of our results are results of [14] and [18].

Increase of the beta or alpha-globulins is connected with the reactive irritation of reticul-endotel system as a result of toxic damage of the liver cells [19]. Our established, raised of the beta-globulins that are possible using in the deferential diagnostically attitude according parental toxication, at that usually is observed increased of the gamma-globulins [19]. The total quantity of the globulins keeps as albumin/globulin coefficient decrease strongly. Consequently, at chronic treatment of the rabbits with lead and cadmium is observed well appearance hyperbeta-globulinemia with hypoalbuminemia of background of one norm or weakly appearance of hypoproteinemia and low A/G coefficient. The decreased of the albumins is so much higher, that degree of liver damage is higher [20]. Raised need of the methionin and cestin for the organism at toxic effect of lead and cadmium [13], as so the higher level of the beta-globulins in blood, that is indication not only break of proteins, but so fat exchange.

CONCLUSION

The chronic accepting of the lead (5mg/kg b.w) and cadmium (2mg/kg b.w) in rabbits lead to liver parenchyma damage, in result of raised levels of the ASAT and ALAT and cholesterol; develop of hypoalbuminemia and hyper-globulinemia of background of one general hypoproteinemia and decrease of the A/G coefficient. These changes dependent on the time and influence of the toxic factor, that is markedly at chronic poisoning with cadmium.

In the deferential diagnostically attitude the hyperbeta-globulinemia, that is possible used as criterion for deferential of enteral from parenteral chronic toxication in animals.

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