Tissue Accumulation and Urinary Excretion of Chromium in Lambs Supplemented with Chromium Picolinate

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Introduction

Chromium (Cr), in its trivalent form (Cr^{3+}), is an essential nutrient because it is involved in the metabolic pathways for carbohydrates, lipids and proteins. Its most important believed function is the potencialization of insulin action.

In human and animal feeds, chromium supplementation is done by addition of Chromium piccolinate (CrPic) on food. However, Cr is a heavy metal and it has potencial to accumulate in biological tissues and then, the risk of biaccumulation and biomagnification (when the level of bioaccumulation increses exponencially between trophic levels) exists.

Purpose

This work aims to investigate Cr concentrations in liver, kidney, spleen, heart, lymph node, skeletal muscle, bone, testis and urine after CrPic oral supplementation.

Material and Methods

Twenty four Santa Inês male lambs were used. The initial mean body weight was 22.89 ± 2.23 kg. The lambs were assigned in four treatments with different levels of chromium picolinate: placebo, 0.250, 0.375 and 0.500 mg of chromium/animal/day. The lambs were kept in individual pens during two weeks for adaptation and 84 days for chromium supplementation and were feed with *Panicum maximum* cv Massai hay and concentrate (85% of cassava flour, 11.5% of mineral salt and 3.5% of urea). After that, animals were slaughtered and Cr tissue concentration was measured by ICP-MS using ^{52}Cr as collected mass.

Results

There was a positive linear relationship between dose administered and the accumulation of mineral in the heart, lung and testis (Table 1). Urinary excretion of chromium occurred in a time and dose-dependent manner (Figure 1), so the longer or more dietary Cr provided, the greater excretion of the mineral.

Table 1. Chromium tissue concentrations (and regressions) in Lambs supplemented with CrPic.

Tissue	Treatments (mg of CrPic/Day)				Standart Deviation	Regression	
	0.000	0.250	0.375	0.500		Linear	Square
Liver (ppm)	1.62	1.71	1.74	1.36	0.17	ns[1]	ns
Kidney (ppm)	2.96	3.05	3.57	2.64	0.39	ns	ns
Spleen (ppm)	1.61	1.92	1.62	1.93	0.18	ns	ns
Heart (ppm)	1.75	2.00	2.01	2.14	0.16	0.0162	ns
Lymph node (ppm)	6.01	7.23	6.41	5.68	0.67	ns	ns
Muscle (ppm)	3.04	4.33	3.55	3.60	0.53	ns	ns
Bone (ppm)	10.92	11.73	10.65	12.18	0.71	ns	ns
Lung (ppm)	1.41	1.61	1.67	2.08	0.28	ns	0.0049
Testis (ppm)	3.30	3.60	4.65	4.21	0.61	0.04	ns

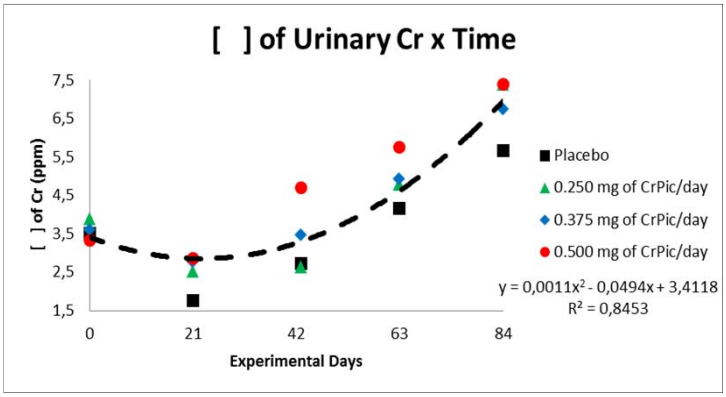
[1]ns = not significant (p=0.05).

Table 2. Urinary Cr concentration, standart deviation and kind of regression in different times of CrPic lamb supplementation.

Experimental Day	Treatments (mg of CrPic/day)				Standart Deviation	Regression	
	0.000	0.250	0.375	0.500		Linear	Square
0	3.51	3.90	3.61	3.09	0.34	ns[1]	ns
21	1.77^{a}	2.53^{ab}	2.76^{b}	2.85^{b}	0.49	0.002	ns
43	2.72^{a}	2.63^{ab}	3.46^{ac}	4.69^{d}	0.95	ns	< 0.0001
63	4.15^{a}	4.78^{ab}	4.91^{ab}	5.76^{b}	0.66	0.004	ns
84	5.66^{a}	6.60^{b}	6.75^{bc}	7.40^{c}	0.72	0.0001	ns

[1]ns = not significant (p=0.05). Different letters in the same line means significative differences.

Figure 1. Relationship between urinary Cr concentration in CrPic supplemented lambs and time.



Conclusion

There was a positive linear relationship between dose administered and the accumulation of mineral in the heart, lung and testis. Urinary excretion of chromium occurred in a time and dose-dependent manner, so the longer or more dietary Cr provided, the greater excretion of the mineral. Bones and lymph nodes can be natural reservoir places of Cr. Thus, there is a risk of bioaccumulation and biomagnification due to Cr offered in the CrPic form.

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