Effect of sodium selenite on male Sprague-Dawley rats exposed to sublethal dose of cadmium chloride

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Introduction Cadmium (Cd) is a dangerous occupational and environmental toxin which can affect livestock and human health. It accumulates in liver and kidneys of Cd exposed animals and humans. Cadmium half-life is about 10 years, so the symptoms of cadmium intoxication may occur several years after the exposure. Selenium (Se) is generally recognized as an important antioxidant with numerous protective biological functions. The principal role of Se is associated with the control of lipid peroxidation because this trace element is a component of selenoenzymes contributing to the antioxidant system. In spite of intense research during recent years, the role of this microelement needs further elucidation. Therefore this study examined the role of Se as Sodium selenite in minimising the harmful effects of Cadmium chloride in male Sprague-Dawley rats.

Materials and methods Following approval by the Quaid-i-Azam University Islamabad, Pakistan's Ethics Committee, twenty male Sprague Dawley rats (28 days old) were housed at the animal unit of this University. The rats were acclimatized to their housing and feeding for two weeks before they were weighed and distributed into four groups of 5 rats each with similar initial body weight (BW) per group. These rat groups were randomly housed in steel cages (38x23x10cm) which were maintained in a room at 25±2^{o}C with dark to light cycle of 14 to 10 hours. A same commercial diet and fresh water was available *ad libitum* to these rats throughout this study. The rats were injected with subcutaneous doses (1mg /kg BW) of normal saline (Control), Cadmium Chloride (Cd group), Sodium selenite (Se group) and Cadmium chloride + Sodium selenite (Cd-Se group) on alternate days for four weeks of this study. All rats were then weighed at weekly intervals for four weeks before their sacrifice on 29th day, to collect their blood, livers and kidneys. The livers and kidneys were weighed and these weights were expressed as g/100g final BW. Cd and Se contents in blood, liver and kidneys were determined by atomic absorption and haemoglobin (Hb) in blood was determined by a spectrophotometer. The data were then statistically analysed as a completely randomised design with repeated measures for body weight by using ANOVA in Minitab software. The analysis compared the effect of above mentioned treatments on weekly BW, tissues and metals in different tissues at $P<0.05$. Tukey's test was used to compare treatments means at $P<0.05$.

Results Table 1 shows significant differences between different treatments for mean weekly BW from week 2 onwards and different tissues of rats ($P<0.05$). While the initial mean BW of rats was similar, it was lower for Cd (>0.05) but greater ($P<0.05$) for Se than the control group for most weeks. The Cd-Se rats showed more comparable BW to the control group. The mean liver and kidney weights and Hb were significantly lower in the Cd ($P<0.05$) than the Control, Se and Cd-Se groups ($P<0.05$) but these did not differ between the Cd-Se and Control groups ($P>0.05$). Table 2 shows that the Cd contents were many folds higher in blood, kidneys and livers for the Cd than the control group whereas it was below the detection limit in Se group. While Cd content in livers and kidneys for the Cd-Se group was many fold higher than the control group it was lower than the Cd group.

Table 1 Weekly (W) mean BW (g), liver and kidney weights (g/100g BW) and Hb (g/dL) of rats for different treatment groups

	'Control group	Cd Control	Se group	Cd-Se group	SEM
Initial BW	86.2	86.6	86.2	83.5	2.81
W1	111.2^{ab}	105.8^{a}	122.2^{b}	112.3^{ab}	3.00
W2	146.6^{a}	136.2^{a}	166.2^{b}	147.8^{a}	3.70
W3	185.4^{b}	170.6^{a}	218.6^{c}	192.8^{b}	3.84**
W4	217.6^{b}	199.8^{a}	258.0^{d}	226^{c}	3.83***
Liver	4.73^{bc}	4.08^{a}	4.85^{c}	4.69^{b}	0.06***
Kidney	0.87^{b}	0.70^{a}	0.80^{b}	0.80^{b}	0.02*
Hb	12.34^{b}	10.38^{a}	14.06^{c}	12.35^{b}	0.16***

(*Means with similar letters in columns did not differ significantly; *=P<0.05; **=P<0.01; ***=P<0.001)*

Table 2 Mean Cadmium (Cd) and Selenium (Se) contents (mg/kg) and SEM in different rat tissues for different treatment groups

Tissues	Cadmium Contents					Selenium Contents				
	Control	Cd	Se	Cd-Se	SEM	Control	Cd	Se	Cd-Se	SEM
Blood	0.03^{a}	0.07^{b}	ND	0.10^{c}	0.002***	3.73	2.93	2.90	2.40	0.30
Kidney	0.02^{b}	3.50^{a}	ND	3.05^{a}	0.17***	2.60^{b}	3.70^{c}	3.40^{bc}	1.40^{a}	0.32
Liver	0.02^{b}	4.17^{a}	ND	3.71^{a}	0.172***	2.92^{a}	2.42^{a}	2.42^{a}	1.13^{b}	0.31

*(Means with similar letters in columns did not differ significantly; ***=P<0.001)*

Conclusion This study indicates that selenium in the form of Sodium selenite may have a protective effect against cadmium chloride induced toxicity in male Sprague-Dawley rats.

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