

## PROTEINURIA AND PREALBUMIN (PA) AND RETINOL BINDING PROTEIN (RBP) LEVELS IN WORKERS EXPOSED TO CADMIUM

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### ABSTRACT

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A mild but distinct increase of proteinuria in some of the workers exposed to cadmium oxide dust was observed. While a positive correlation between serum prealbumin and retinol binding protein levels was demonstrated, the tendency to increase in serum was found only in the case of retinol binding protein (RBP).

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It is well known that chronic exposure to cadmium tends to lead to renal tubular damage<sup>3,4</sup>. Proteinuria of the tubular type<sup>1</sup> is often an early sign of cadmium intoxication in such cases<sup>4</sup>.

Renal tubular damage, even from cadmium intoxication, can be recognized from an increased level of several low molecular weight serum proteins in urine<sup>12,15,21</sup>. One of these proteins, which are markers of tubular type proteinuria<sup>6,11</sup>, is retinol binding protein (RBP) normally catabolized by the kidney<sup>12,13,14,17</sup>. However, data concerning the serum RBP level in chronic tubular dysfunction are rather rare and different<sup>5,18,19,20</sup>.

As recent investigations showed that the blood RBP is not free but incorporated in a specific protein complex together with prealbumin (PA) molecules<sup>5,10,13,16</sup> our study concentrated on examinations of the serum level of both proteins in workers exposed to cadmium dust. The total urinary protein concentration in these workers was also determined.

### SUBJECTS AND METHODS

The proteinuria, RBP and PA serum concentration were determined in a group of 50 workers who have been exposed to cadmium dust in a battery factory ("Krušik", Valjevo, Serbia) for 5–20 years. The workers showed no clinical signs of cadmium intoxication. The average age of the workers was 37.7 years and average cadmium exposure 11.0 years.

A group of 20 workers working at the same factory but not exposed to cadmium was included as control.

The urinary protein concentration was determined by the tannic acid method<sup>2,8,9</sup>. RBP and PA serum levels were examined after Mancini and co-workers<sup>7</sup> using commercial Partigen Behringwerke plates. All data were analysed using the analysis of variance with statistically significant differences. The relationships between variables were tested with linear regression lines and the correlation coefficient.

## RESULTS

### Urinary protein concentration

The data obtained after the total urinary protein level was determined are presented in Figure 1. A slight (between 0.2 and 0.6 g/l) but distinct increase of proteinuria was found in 11 (22.0%) workers exposed to cadmium. No age related prevalence or dependence on cadmium exposure of increased proteinuria was found (Fig. 2).

In the control group, however, no value was found to be higher than 0.1 g/l.

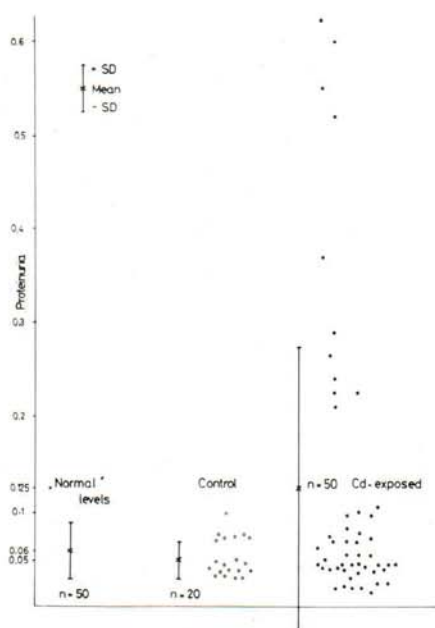


FIG. 1—Individual and mean values of proteinuria (g/l) in cadmium exposed workers and in corresponding controls.

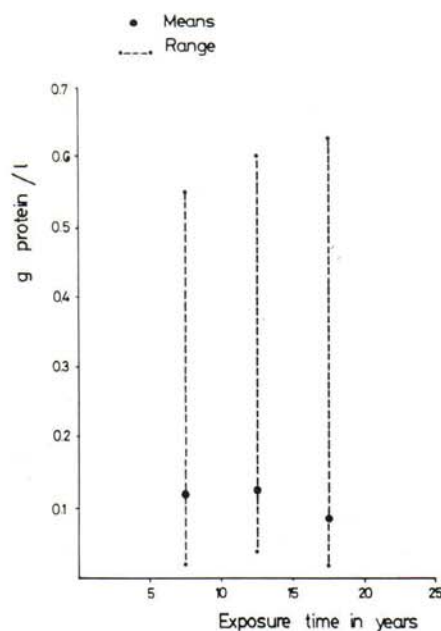


FIG. 2—Relationship between length of exposure and protein excretion for 50 cadmium workers divided into 5-year exposure groups.

## Serum RBP and PA levels

The serum PA concentration in workers exposed to cadmium, presented in Table 1, is not different from the PA level in the corresponding control group. On the contrary, the RBP concentration in serum indicates a difference between the two groups: the average RBP concentration is higher in the group exposed to cadmium than in the control group. In spite of that a statistically significant positive correlation between PA and RBP serum levels was found (Fig. 3).

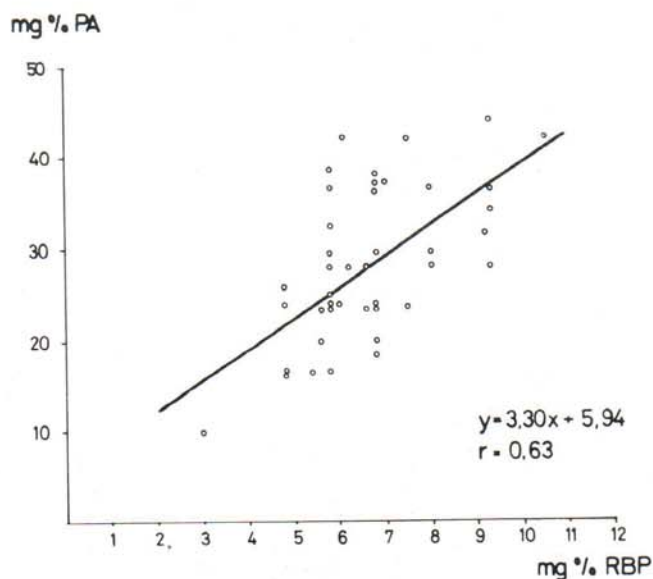


FIG. 3—Prealbumin (PA) serum concentration (mg/100 ml) in relation to retinol-binding protein (RBP) serum concentration (mg/100 ml) in cadmium exposed workers.

TABLE 1  
Concentrations (mg %) of PA and RBP in the sera of cadmium exposed and control workers.

		N	Mean	S.D.	Significance of difference
PA	Control workers	20	27.06	7.17	NS
	Cd-workers	50	28.32	7.84	
RBP	Control workers	20	5.65	1.26	p < 0.01
	Cd-workers	50	6.67	1.53	

## DISCUSSION

Our results show a mild (0.2–0.6 g/l) increase of proteinuria in 22% of the cadmium exposed workers who had no clinical signs of cadmium intoxication. Increased proteinuria has been a common finding in cadmium workers<sup>4</sup>. However, in many investigations concerning urinary protein concentration only qualitative tests were used for detecting proteinuria, so that our results may be added to the less abundant quantitative data.

Although proteinuria may appear alone without other signs of cadmium intoxication, there may exist a slight increase in certain urinary proteins while the total excretion of proteins still keeps within normal range. This is the reason why urinary proteins in cadmium workers should be studied further in connection with some serum low molecular weight proteins which are usually used as markers of the tubular proteinuria type:  $\beta_2$ -microglobulins, free Ig light chains and RBP, for instance<sup>17,22</sup>.

Our data on PA and RBP serum concentration suggest a slight tendency of RBP to increase although the prealbumin level remained normal. The discrepancy between the RBP and PA levels in serum might indicate an impaired function of the kidney in RBP metabolism. Since the kidney is not a major organ of PA catabolism, an unchanged serum concentration of the latter is not unexpected even in the case of a kidney disease<sup>4</sup>.

However, more detailed studies of RBP and PA concentration are motivated. Since the RBP is vitamin A carrier<sup>5,10,17</sup> such studies should include the examination of urinary RBP level as well as vitamin A concentration in serum and its renal excretion.

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