

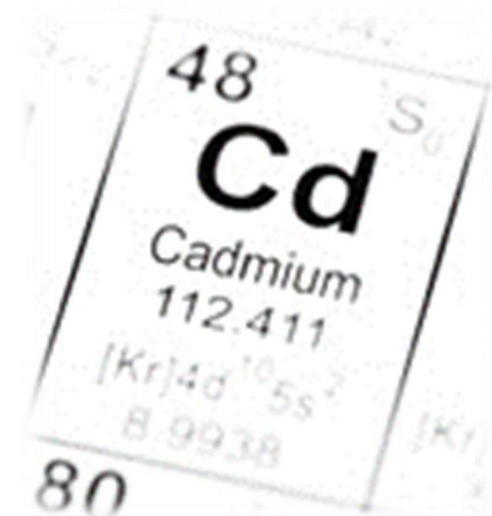


A.I.S.E.T.O.V.

Assessment of selenium and cadmium levels in serum and toenails: A cross-sectional study in Modena, Northern Italy.

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Background and aims

Cadmium (Cd) is a heavy metal established as a human carcinogen while selenium (Se) is a metalloid showing an intriguing and still unclear relation with human health, particularly with cancer. Se is usually present both in the environment and in living organisms in various inorganic and organic forms, having considerable variations in both their toxicological and physiological properties.

The aim of this study was to assess their reference values and individual determinants influencing their content in fifty adults randomly drawn from the municipality of Modena, by determining Se and Cd levels in plasma and in toenails.

Methods

We determined Se and Cd content in serum samples using anion exchange chromatography (IEC) coupled with inductively coupled plasma mass spectrometry and total Se additionally by GFAAS, according to methodologies previously established for biological matrices. We also measured toenail Se and Cd concentration using a Zeeman-effect corrected graphite-furnace atomic absorption spectrometer. Pearson correlation between serum and toenails content was computed.

Results

In serum, median (25th-75th) Se levels for total, inorganic and organic forms were 119.0 µg/L (109.0-136.), 21.6 µg/L (8.9-38.7) and 66.4 µg/L (33.0-89.3), respectively. In general for all Se species, levels were higher in men; total and inorganic Se forms were higher in older subjects, while organic in younger ones. In toenails Se levels were 0.93 µg/g (0.82-1.15), with higher content in men. Correlation coefficients between serum Se species and toenails content were 0.023 (95% CI -0.254, 0.297; $P=0.606$) for total Se, -0.040 (95% CI -

0.312, 0.238; $P=0.780$) for inorganic Se species, -0.045 (95% CI -0.317, 0.233; $P=0.752$) for organic forms.

Cd serum median content was 40.6 ng/L (30.1-53.5), and results were similar for both sexes, while levels were higher in the youngest subjects. Toenails Cd level was 5.70 ng/g (0.50-11.78), with major content in women and older participants. In general, all values were higher in overweight subjects. Correlation between serum and toenails levels was -0.071 (96% CI -0.340, 0.208; $P=0.619$).

Category (n)	Total Se	Inorganic Se	Organic Se	Toenail Se	Serum Cd	Toenails Cd
	50 th (25 th -75 th)	50 th (25 th -75 th)	50 th (25 th -75 th)	50 th (25 th -75 th)	50 th (25 th -75 th)	50 th (25 th -75 th)
Total (51)	119 (109-136)	21.6 (8.9-38.7)	66.4 (33.0-89.3)	0.93 (0.82-1.15)	40.6 (30.1-53.5)	5.7 (0.5 - 11.8)
Men (26)	123 (113-139)	20.0 (8.5-38.7)	75.7 (37.0-92.7)	0.86 (0.79-1.04)	40.0 (32.1-54.8)	6.5 (0.5 - 10.7)
Women (25)	115 (103-135)	23.8 (9.2-34.8)	60.0 (33.0-76.5)	0.98 (0.89-1.18)	40.6 (29.1-50.6)	5.7 (0.5 - 12.2)
<50 years (23)	109 (102-120)	11.1 (6.9-23.8)	78.2 (61.2-92.7)	0.93 (0.84-1.17)	43.0 (36.5-58.7)	5.6 (0.5 - 10.7)
≥50 years (28)	131 (118-139)	32.0 (17.2-46.1)	52.9 (24.3-78.7)	0.93 (0.76-1.12)	35.8 (28.3-47.4)	6.9 (0.5 - 15.4)
<25 BMI (23)	115 (107-136)	23.8 (11.1-38.8)	59.2 (18.8-83.5)	0.92 (0.84-1.21)	37.7 (29.4-48.2)	5.7 (0.5 - 11.4)
≥25 BMI (28)	125 (110-138)	18.4 (8.7-36.4)	68.8 (44.1-91.3)	0.94 (0.80-1.07)	43.2 (31.0-61.1)	5.8 (0.5 - 12.0)

Table. Distribution of selenium and cadmium in serum and toenails.

Conclusions

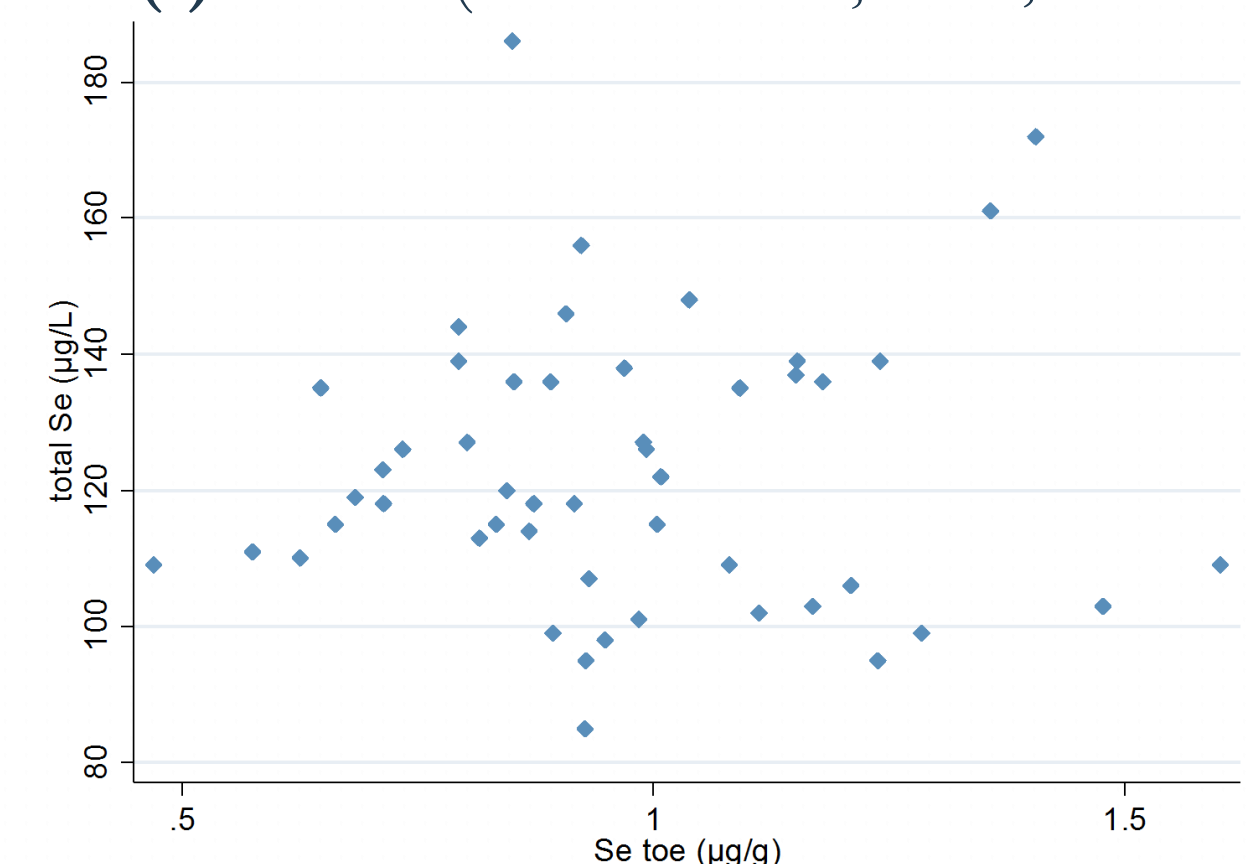
Our cross-sectional study provided reference values of Se and Cd for the Modena municipality residents, even if the estimates were imprecise due to the limited number of study subjects. The null or inverse correlations between serum and toenails levels could be due to the different time window of exposure reflected by the matrices, because serum

content is largely related to recent exposure with half time of few days, while toenails matrix could reflect medium or long-term exposure. Alternatively, lack of correlation may reflect a different distribution of selenium and cadmium in the various body districts. Overall, these factors should be considered in the assessment of exposure to Se and Cd.

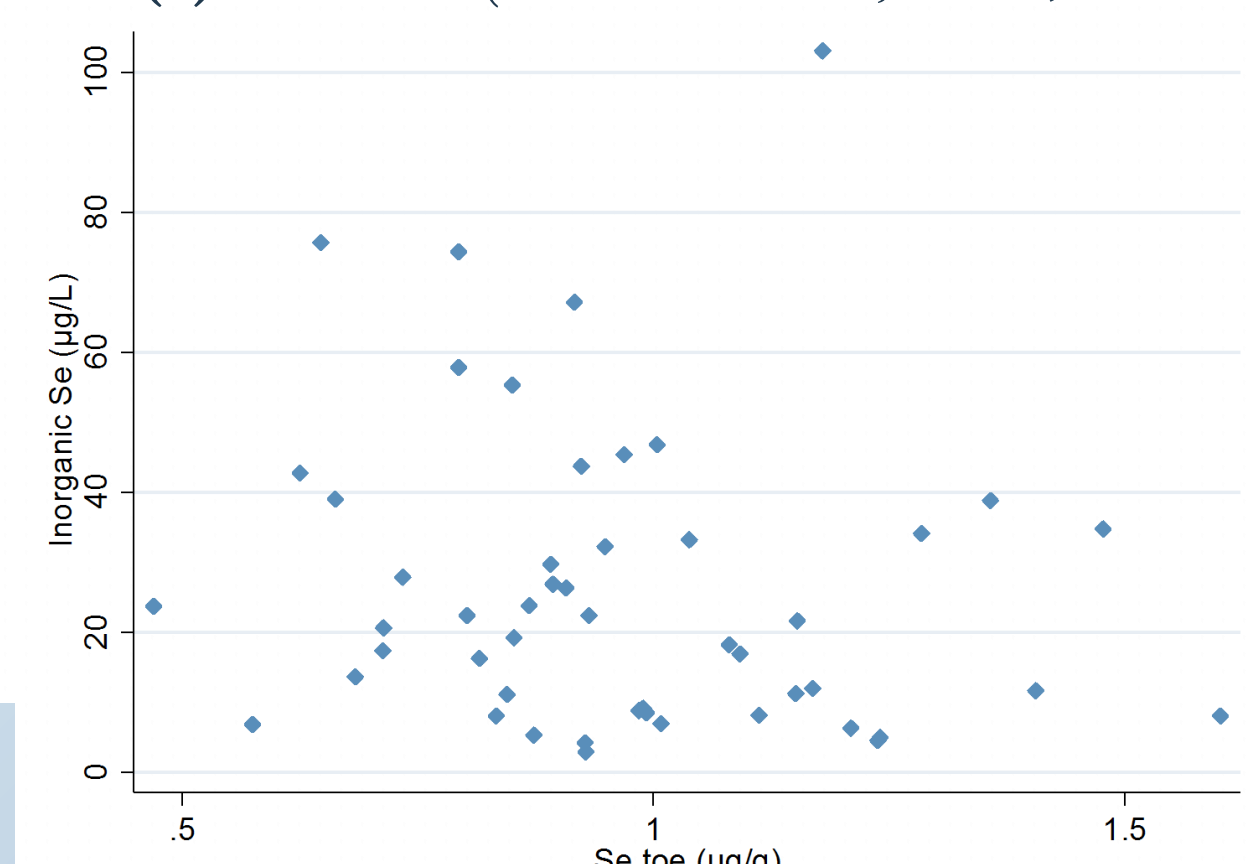
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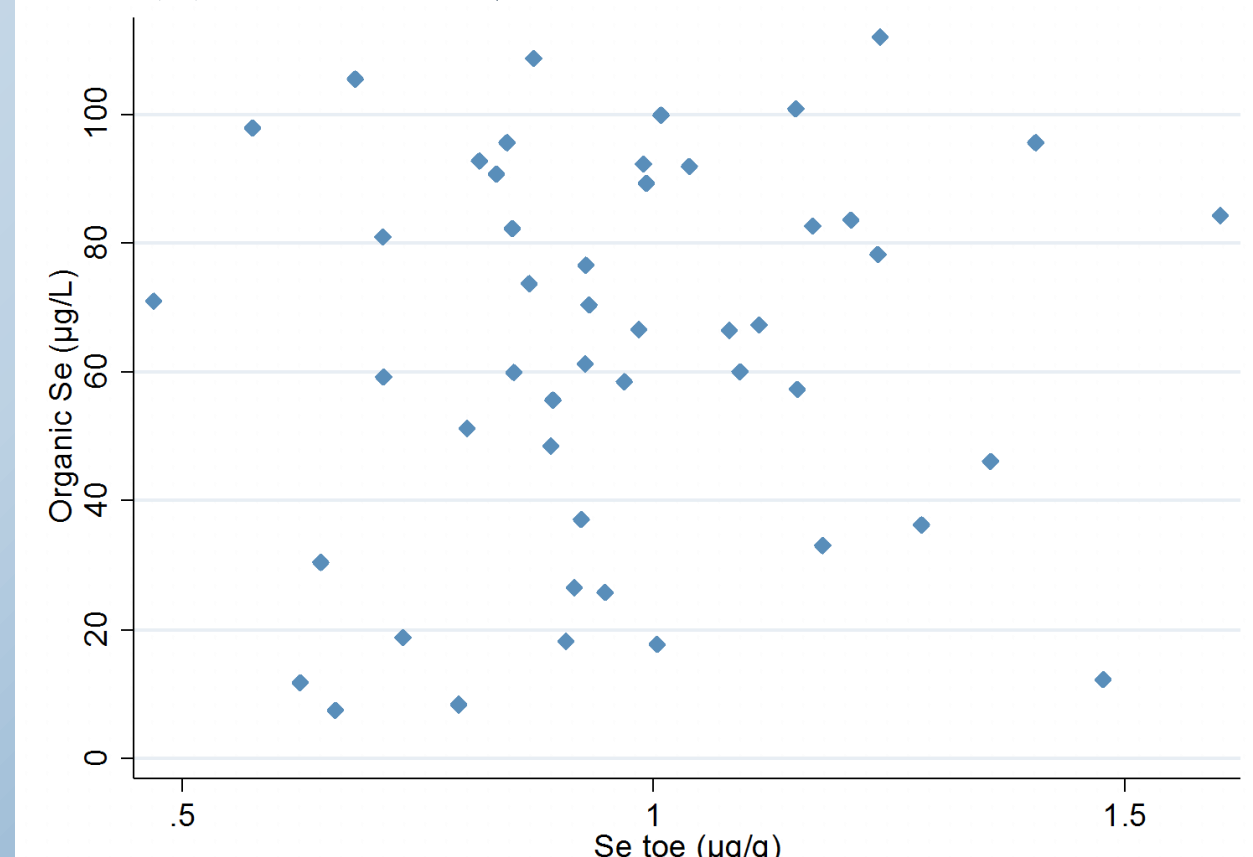
(1) $r=0.023$ (95% CI -0.254, 0.297; $P=0.606$)



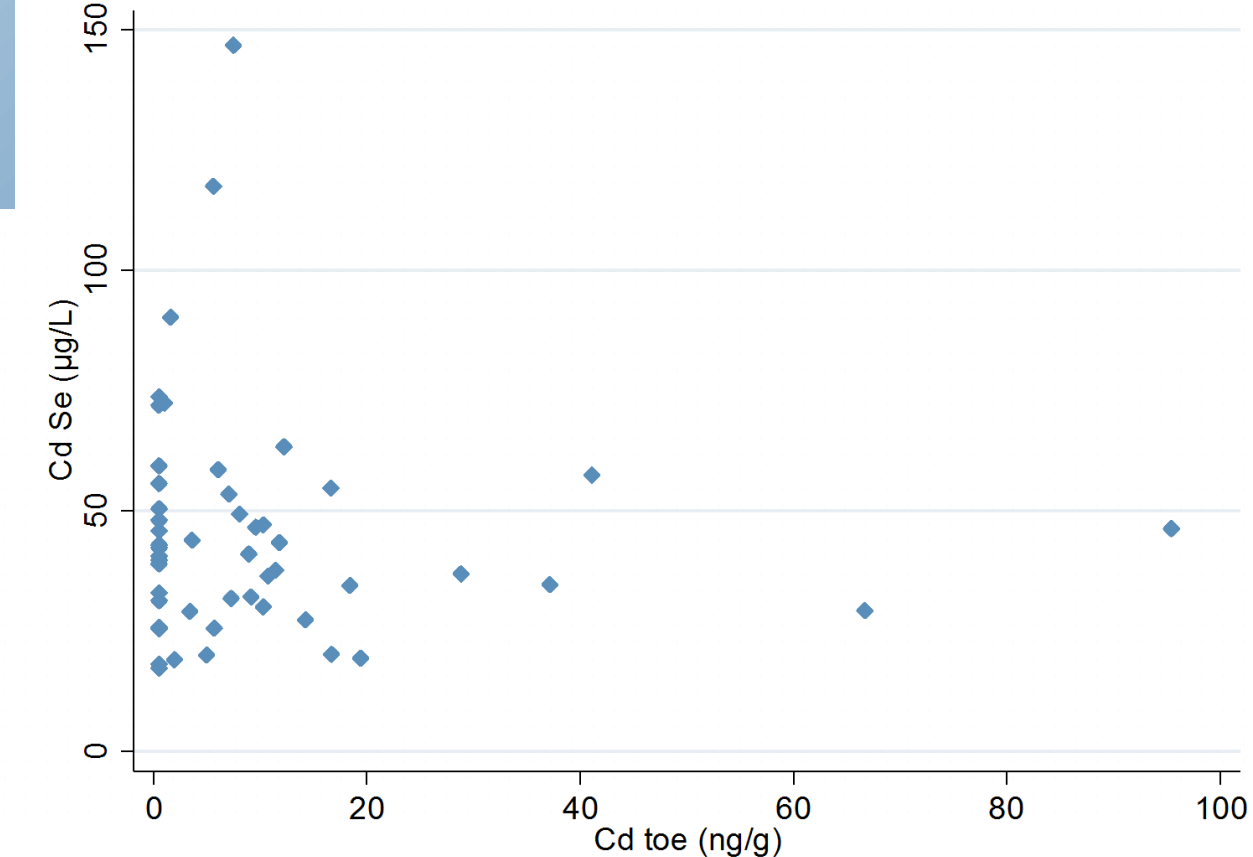
(2) $r=-0.040$ (95% CI -0.312, 0.238; $P=0.780$)



(3) $r=-0.045$ (95% CI -0.317, 0.233; $P=0.752$)



(4) $r=-0.071$ (96% CI -0.340, 0.208; $P=0.619$)



Figures: Plots with the correlation between serum and toenails content of Se forms (1-3) and Cd (4).

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keywords
inorganic
body
toenails
population
smoking
subjects
human
biological matrix
sample
exposition
selenium
research
speciation
correlation
cadmium
age
diet
toxicity
limitations
assessment
epidemiology
trace elements
methodology
BMI
contaminants



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