Se-human serum albumin (Se-HSA) in human serum and its correlation with other selenium species

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Background and Aims

Selenium (Se) speciation is a key issue for both nutritional and toxicological implications, taking into account the inorganic or organic features of the various Se compounds. The present study focused on human serum albumin bound-selenium (Se-HSA), a species with still uncertain physiological significance and not directly introduced in the physiological Se-cycle, being due to accidental incorporation of selenomethionine into HSA sequence.

Methods

We determined levels of total Se and Se species in 50 serum samples drawn from the general population of a Northern Italy community using anion exchange chromatography coupled with inductively coupled plasma dynamic reaction cell mass spectrometry according to methodologies previously established for biological matrices. Correlations between Se-HSA and the other Se compounds and to habits or characteristics of sample donors were performed. We also analyzed the association between Se-HSA and other variables using linear regression models, crude and adjusted for potential confounders.

N=50	50th	25th-75th
Total Se	118.5	(109.0 - 136.0)
Inorganic Se	21.1	(8.9 - 34.8)
Se-IV	15.8	(6.6 - 29.2)
Se-VI	3.1	(1.5 - 7.3)
Organic Se	95.9	(80.7 - 108.8)
SePP	26.9	(3.4 - 48.8)
SeM	0.01	(0.01 - 2.0)
SeC	2.6	(0.8 - 4.7)
GpX	17.1	(11.1 - 24.0)
TrxR	6.0	(3.7 - 10.1)
HSA-Se	25.5	(16.2 - 51.5)
Unknown	0.01	(0.01 - 3.2)

Table 1. Distribution of total Se and Se species of study subjects. Data in µg/L

Results

Median (25th-75th) level of the Se-HSA was 25.5 µg/L (16.2-51.5), representing about 20% of total Se (Table 1). Se-HSA directly correlated with age (r=0.43, 95% CI 0.18 to 0.71) and storage time (r=0.69, 0.51 to 0.81), while inversely with body mass index (r=-0.32, -0.55 to -0.05). Null relation was found with sex and smoking habits (Table 3). Using Se-HSA as dependent variable, regression (β) coefficient of organic Se species was -0.48 (-0.63 to -0.33) and -0.30 (-0.47 to -0.13) in crude and adjusted analysis, inorganic forms were directly associated in both the crude (β 0.52, 0.22 to 0.83) and adjusted analysis (β 0.11, -0.19 to 0.41) (Table 5 and Figure 1).

	n	50th	25th-75th	Pa
Total subjects	50	25.5	(16.2 - 51.5)	
Sex				
Males	26	28.6	(16.2 - 48.1)	0.153
Females	24	23.2	(16.7 - 53.0)	
Age				
<50 years	23	16.2	(13.3 - 23.1)	0.001
≥50 years	27	39.8	(25.5 - 57.9)	
BMI				
<25 BMI	22	24.9	(16.0 - 54.5)	0.802
≥25 BMI	28	25.5	(18.7 - 41.4)	
Smoking habits				
Non-smokers	26	24.0	(16.2 - 43.0)	
Ex-smokers	15	30.7	(17.9 - 54.5)	0.214
Smokers	9	25.5	(15.3 - 39.8)	

Table 2. Se-HSA for all subjects and in specific subgroups. [a]P value of nonparametric equality-of-medians test.

	r	95% CI	P
Age	0.432	(0.175 to 0.634)	0.002
BMI	-0.323	(-0.552 to -0.049)	0.022
Sex	0.029	(-0.251 to 0.305)	0.841
Smoking habits	-0.001	(-0.279 to 0.278)	0.995
Storage time	0.692	(0.512 to 0.813)	<0.001

Table 3. Person's correlation between Se-HSA and habits or characteristics of sample donors

	r	95% CI	P
Total Se	0.532	(0.298 to 0.706)	<0.001
Inorganic Se	0.450	(0.196 to 0.647)	0.001
Se-IV	0.457	(0.205 to 0.653)	<0.001
Se-VI	0.179	(-0.105 to 0.435)	0.215
Organic Se	-0.683	(-0.808 to -0.500)	<0.001
SePP	-0.631	(-0.773 to -0.428)	<0.001
SeM	-0.182	(-0.438 to 0.102)	0.207
SeC	0.143	(-0.141 to 0.405)	0.323
GpX	-0.259	(-0.501 to 0.021)	0.070
TrxR	-0.065	(-0.338 to 0.217)	0.652
Unknown	0.351	(0.080 to 0.573)	0.013

Table 4. Person's correlation between Se-HSA and total Se and other Se-compounds.

	βa	95% CI	P	βb	95% CI	P
Inorganic Se	0.52	(0.22 to 0.83)	0.001	0.11	(-0.19 to 0.41)	0.459
Se-IV	0.59	(0.26 to 0.93)	0.001	0.17	(-0.15 to 0.49)	0.296
Se-VI	0.99	(-0.59 to 2.57)	0.214	-0.66	(-2.00 to 0.68)	0.328
Organic Se	-0.48	(-0.63 to -0.33)	<0.001	-0.30	(-0.47 to -0.13)	0.001
SePP	-0.51	(-0.69 to -0.33)	<0.001	-0.31	(-0.49 to -0.13)	0.001
SeM	-1.16	(-2.98 to 0.66)	0.207	-1.15	(-2.59 to 0.28)	0.113
SeC	0.72	(-0.73 to 2.16)	0.323	0.13	(-0.99 to 1.25)	0.811
GpX	-0.40	(-0.83 to 0.03)	0.070	-0.02	(-0.38 to 0.35)	0.922
TrxR	-0.25	(-1.34 to 0.85)	0.652	0.01	(-0.81 to 0.84)	0.976
Unknown	1.50	(0.34 to 2.66)	0.013	0.49	(-0.52 to 1.51)	0.334

Table 5. Beta coefficients between HSA-Se and total selenium and other selenium species, crude and adjusted for sex, age, body mass index, smoking habits and storage time.
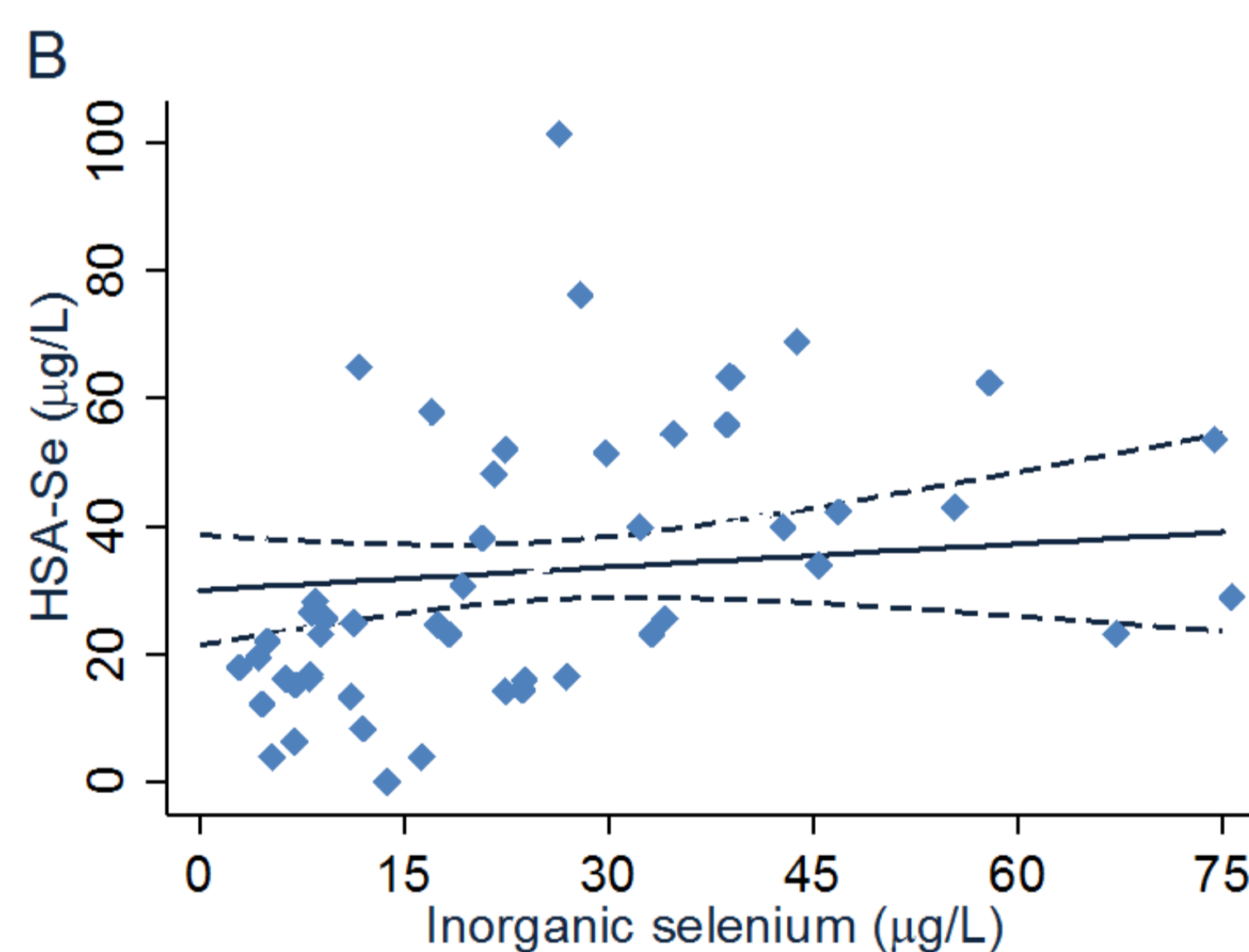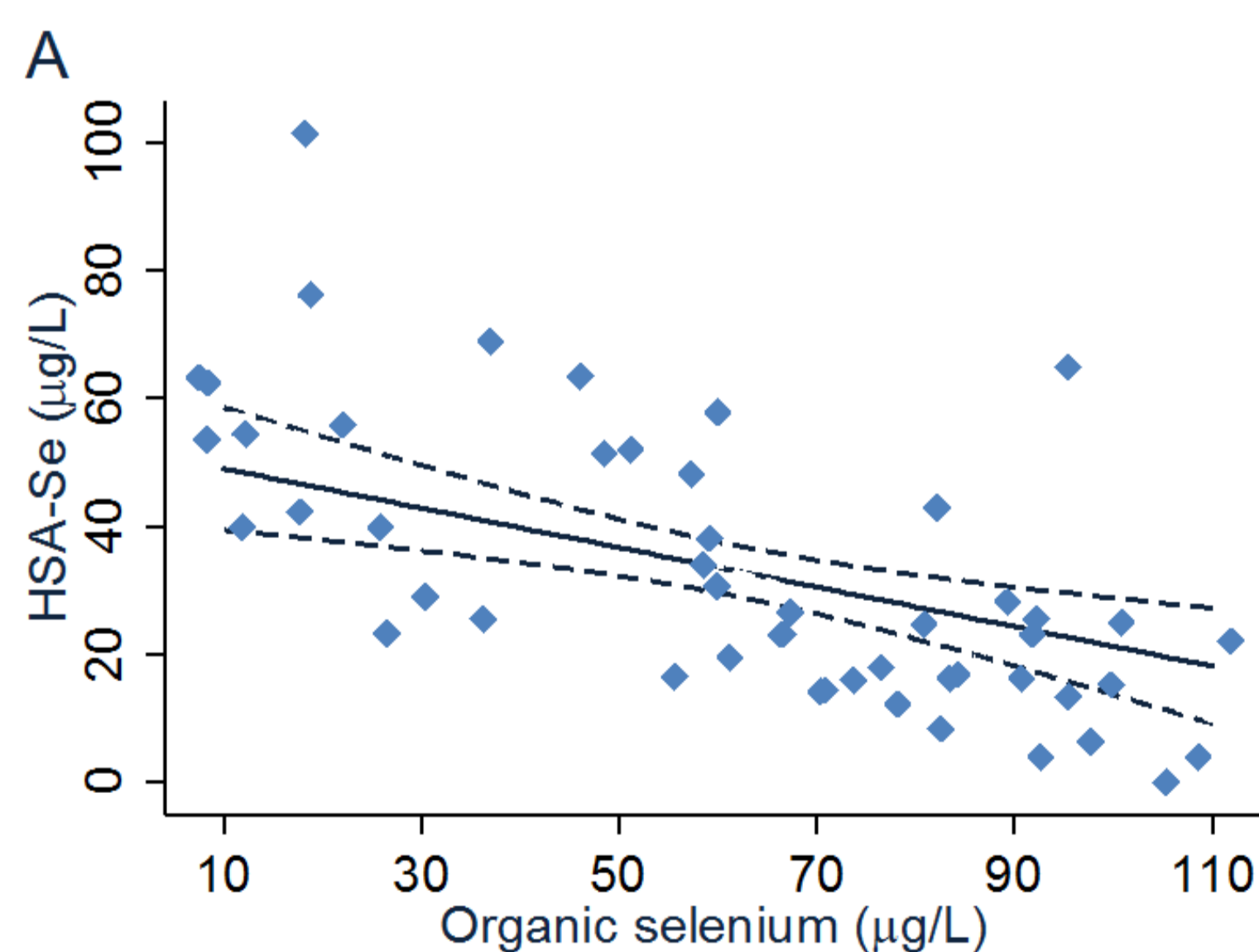

Figure 1. Analyses between Se-HSA and Organic (A) and Inorganic (B) selenium species using bivariate regression model (solid line) with 95% confidence intervals (dash lines), adjusted for age, sex, BMI, smoking habits and storage time.

Conclusions

The inverse relation of Se-HSA with other organic Se species may suggest that content of Se-HSA in serum is lower when seleno-aminoacids are incorporated into other selenoproteins, namely selenoprotein P and glutathione peroxidase that showed strongest inverse relation. Reasons of the positive correlation between Se-HSA and inorganic Se are less clear.

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