Correlation between dietary selenium exposure with biochemical and metabolic parameters: A cross-sectional study in Northern Italy population

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Background and aim

The metalloid selenium shows an intriguing role with human health, with both nutritional and toxicological effects. In particular, recent studies suggest that high selenium exposure could be associated with impairment of metabolism of lipids, glucose and thyroid function. This study aims at assessing dietary levels of exposure to selenium and assess the correlation between selenium levels and biochemical and metabolic parameters in an Italian community.

Methods

In a sample adult population of ever smokers from Reggio Emilia Province we estimated dietary selenium intake through a food frequency questionnaire, validated for the Northern Italy population. From each participant we collected a fasten blood sample for determination of biochemical parameters and hormone levels, including alanine transaminase, blood glucose, total cholesterol, high-density lipoproteins (HDL), and thyroid-stimulating hormone (TSH). All subjects who participated to this study signed a written informed consent.

	All N	All %	Men N	Men %	Women N	Women %	Selenium (µg/day) Mean (SD)
Sex							
Men	46	44.2	-		-		107.95 (47.75)
Women	58	55.8	-		-		95.54 (27.03)
Age							
<50 years	63	60.6	29	63.0	34	58.6	102.87 (36.73)
≥50 years	41	39.4	17	36.9	24	41.3	98.20 (40.00)
BMI							
<25	54	51.9	23	50.0	31	53.4	95.78 (35.94)
≥25	50	48.1	23	50.0	27	46.5	106.70 (39.54)
Se supplement use							
Non-users	17	16.3	6	13.0	11	18.9	104.22 (39.38)
Users	87	83.6	40	87.0	47	81.0	84.68 (24.19)
Smoking habits							
Never smoker	75	72.0	33	71.7	42	72.4	100.17 (41.43)
Former smoker	29	28.0	13	28.3	16	27.6	103.25 (27.37)

Table 1. Characteristics of study subjects and their selenium intake levels.

	All (N=104) Mean (SD)	Men (N=46) Mean (SD)	Women (N=58) Mean (SD)
ALT (U/L)	30 (12)	34 (12)	27 (10)
Glucose (mg/dL)	85 (9)	87 (10)	84 (9)
Total CH (mg/dL)	207 (31)	199 (31)	212 (31)
LDL (mg/dL)	126 (27)	123 (30)	128 (24)
HDL (mg/dL)	61 (14)	52.13 (10.06)	67,53 (13,51)
Triglycerides (mg/dL)	101 (69)	116 (89)	89 (44)
Creatinine (mg/dL)	0,80 (0,14)	0.93 (0.10)	0,76 (0,12)
Ferritine (ng/mL)	48,9 (40,0)	59.2 (43.5)	40,8 (35,3)
Total proteins (g/dL)	7.1 (0.4)	7.2 (0.4)	7,1 (0,4)
TSH (mU/mL)	1.90 (1.61)	1.77 (0.95)	2,00 (1,99)
SBP (mmHg)	121 (7)	121 (6)	121 (8)
DBP (mmHg)	77 (4)	78 (4)	76 (4)

Table 2. Distribution of biochemical and metabolic parameters in all study population and according to sex.

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Results

In the 104 participants recruited from March 2017 to May 2018 the mean (standard deviation) dietary selenium intake was 101.0 (47.3) µg/day. According to linear regression analyses, we found negative correlation between selenium intake and HDL levels, while a positive one with TSH levels. Moreover, in sex-stratified analysis, we found a positive association between selenium intake with blood glucose levels in females.

	All (N=104) Beta	All (N=104) (95% CI)	Men (N=46) Beta	Men (N=46) (95% CI)	Women (N=58) Beta	Women (N=58) (95% CI)
ALT	0.010	(-0.049; 0.069)	0.031	(-0.049; 0.111)	-0.073	(-0.189; 0.042)
Glucose	-0.013	(-0.063; 0.037)	-0.044	(-0.102; 0.013)	0.108	(0.004; 0.212)
Total CH	0.025	(-0.136; 0.186)	0.070	(-0.122; 0.263)	-0.167	(-0.526; 0.192)
LDL	0.039	(-0.098; 0.176)	0.061	(-0.121; 0.242)	-0.097	(-0.374; 0.179)
HDL	-0.028	(-0.089; 0.032)	-0.029	(-0.091; 0.034)	-0.022	(-0.167; 0.122)
Triglycerides	0.070	(-0.292; 0.433)	0.192	(-0.382; 0.767)	-0.238	(-0.730; 0.254)
Creatinine	0.000	(0.000; 0.001)	0.000	(0.000; 0.001)	0.000	(-0.001; 0.002)
Ferritine	0.018	(-0.198; 0.234)	-0.017	(-0.303; 0.269)	-0.036	(-0.460; 0.387)
Total proteins	0.000	(-0.003; 0.002)	0.000	(-0.003; 0.002)	-0.001	(-0.006; 0.004)
TSH	0.008	(-0.001; 0.016)	0.004	(-0.002; 0.010)	0.014	(-0.008; 0.036)
SBP	0.007	(-0.028; 0.042)	0.007	(-0.027; 0.041)	0.020	(-0.069; 0.108)
DBP	0.005	(-0.017; 0.027)	0.006	(-0.014; 0.027)	0.017	(-0.033; 0.067)

Table 3. Linear regression models between dietary intake of selenium and biochemical and metabolic parameters, adjusted for age, sex, body mass index, total energy intake, iron and fiber intake.
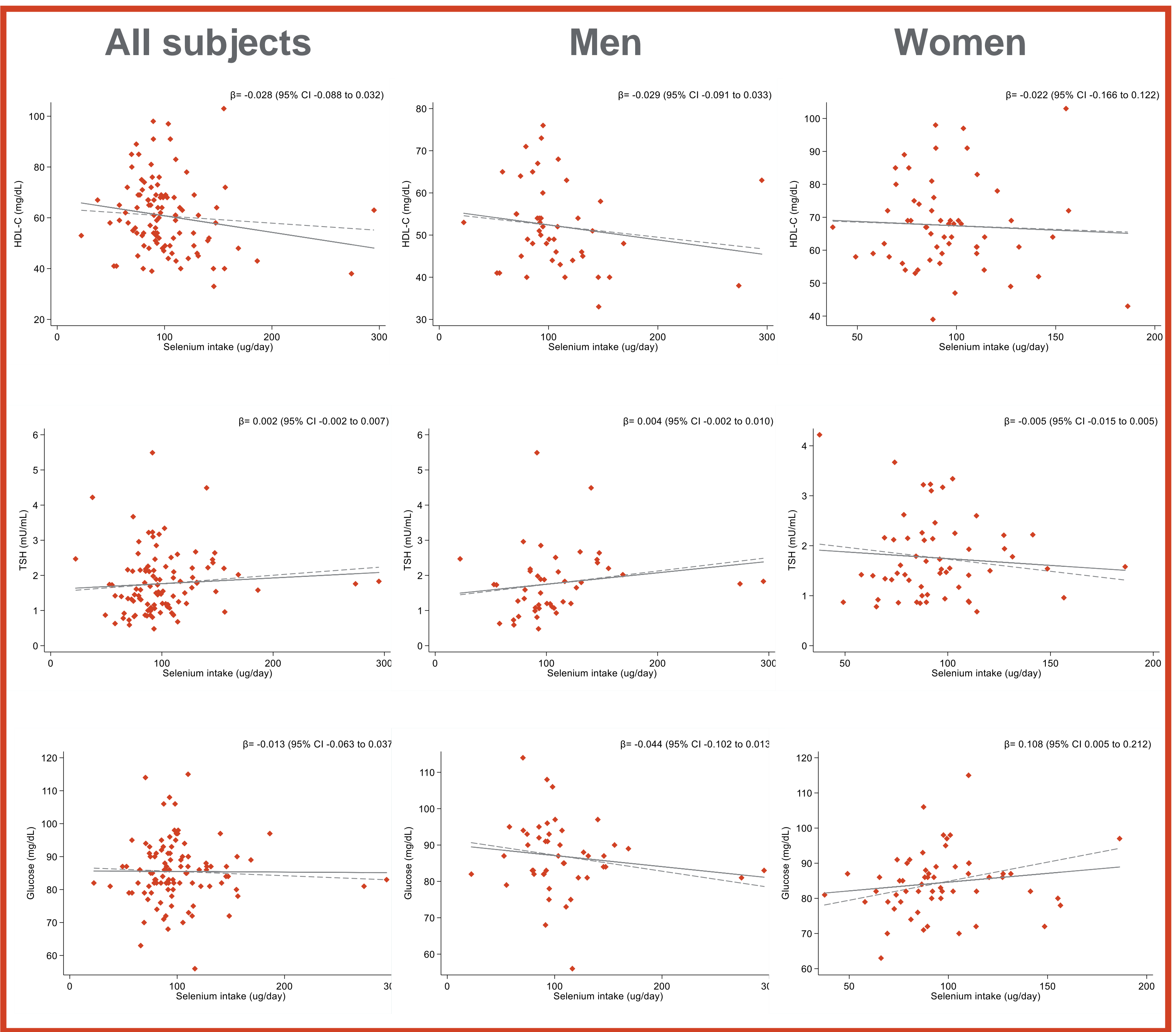

Figure 2. Scatter plots with fitted linear regression model crude (solid line) and adjusted (dash line) between selenium intake (µg/day) and HDL-C, TSH and blood glucose, and divided by sex.

Conclusions

The dietary selenium intake in our Italian population is far above the recommended intake of 70 µg/day by the European Food Safety Authority. Our correlation analyses suggest that even at levels below the upper toxicity limits and generally considered safe, adverse effects on endocrine and metabolic systems could not be excluded, with possible sex-related differences in toxicity susceptibility.

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