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

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Background and aim

Cadmium is a heavy metal classified as carcinogen for humans. It accumulates in the organism, especially in kidney and liver. Recent findings suggested that cadmium could influence human metabolism acting as endocrine disruptor and high cadmium exposure has been associated with impairment of cardiovascular and endocrine systems. This study aims at assessing the dietary intake of cadmium in an Italian community of Northern Italy and to evaluate its correlation with endocrine and metabolic factors.

Methods

In a sample adult population of ever smokers from Reggio Emilia Province we estimated dietary cadmium 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 hormones 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		Men		Women		Cadmium (µg/day)
	N	%	N	%	N	%	Mean (SD)
Sex							
Men	46	44.2	-		-		16.59 (9.37)
Women	58	55.8	-		-		15.47 (4.44)
Age							
<50 years	63	60.6	29	63.0	34	58.6	16.21 (6.78)
≥50 years	41	39.4	17	36.9	24	41.3	15.59 (7.49)
BMI							
<25	54	51.9	23	50.0	31	53.4	15.50 (6.75)
≥25	50	48.1	23	50.0	27	46.5	16.46 (7.38)
Se supplement use							
Non-users	17	16.3	6	13.0	11	18.9	16.50 (7.33)
Users	87	83.6	40	87.0	47	81.0	13.24 (4.59)
Smoking habits							
Never smoker	75	72.0	33	71.7	42	72.4	15.88 (7.57)
Former smoker	29	28.0	13	28.3	16	27.6	16.18 (5.56)

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

	All (N=104)	Men (N=46)	Women (N=58)
	Mean (SD)	Mean (SD)	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.

Results

We eventually recruited 104 participants (men/women: 46/58), with mean (standard deviation) dietary intake of cadmium of 16.0 (8.5) µg/day. Correlation between cadmium intake and biochemical factors demonstrated a positive association with total cholesterol levels, blood glucose and TSH. Adjustment for main confounders, including sex, age, and bass index did not substantially alter the results. No clear correlation emerged with other parameters under investigation.

	All (N=104)		Men (N=46)		Women (N=58)	
	Beta	(95% CI)	Beta	(95% CI)	Beta	(95% CI)
ALT	-0.043	(-0.351; 0.265)	0.006	(-0.401; 0.413)	-0.364	(-0.987; 0.259)
Glucose	-0.027	(-0.287; 0.233)	-0.200	(-0.493; 0.094)	0.541	(-0.022; 1.105)
Total CH	0.736	(-0.089; 1.561)	0.579	(-0.385; 1.543)	1.139	(-0.785; 3.063)
LDL	0.693	(-0.008; 1.395)	0.540	(-0.370; 1.449)	0.984	(-0.488; 2.455)
HDL	-0.091	(-0.405; 0.223)	-0.137	(-0.453; 0.179)	0.015	(-0.764; 0.794)
Triglycerides	0.671	(-1.215; 2.557)	0.883	(-2.033; 3.798)	0.698	(-1.970; 3.366)
Creatinine	0.002	(-0.001; 0.005)	0.001	(-0.002; 0.005)	0.003	(-0.004; 0.011)
Ferritine	0.075	(-1.050; 1.200)	-0.187	(-1.637; 1.263)	0.655	(-1.621; 2.930)
Total proteins	-0.001	(-0.012; 0.010)	-0.002	(-0.014; 0.010)	-0.001	(-0.028; 0.026)
TSH	0.041	(-0.004; 0.085)	0.015	(-0.017; 0.046)	0.116	(0.000; 0.232)
SBP	-0.019	(-0.201; 0.163)	0.033	(-0.139; 0.206)	-0.195	(-0.667; 0.278)
DBP	0.012	(-0.101; 0.125)	0.026	(-0.078; 0.130)	-0.011	(-0.281; 0.260)

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

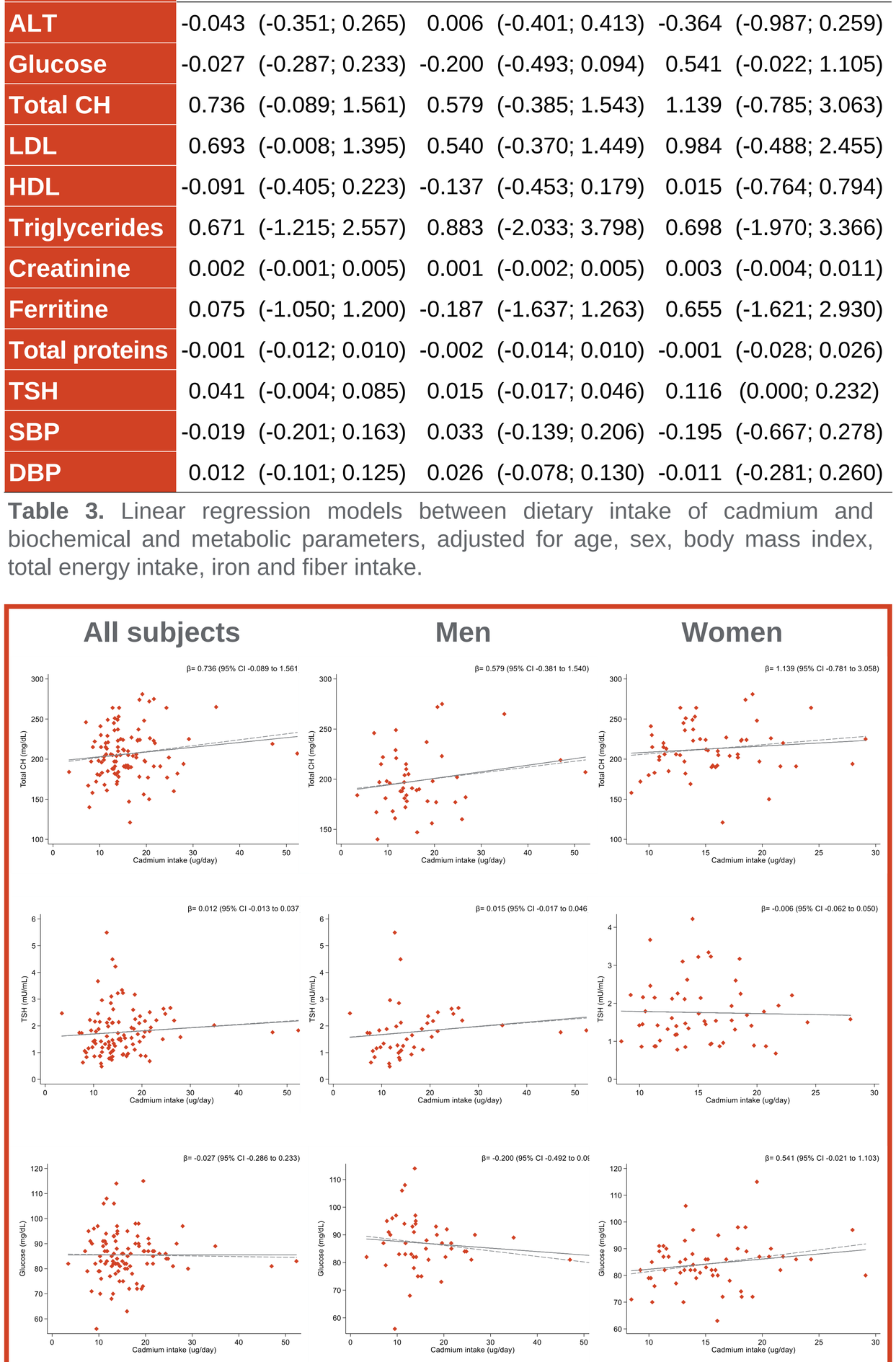

Figure 2. Scatter plots with fitted linear regression model crude (solid line) and adjusted (dash line) between cadmium intake (µg/day) and total CH, TSH and blood glucose, and divided by sex.

Conclusions

The results show that in our sampled population, dietary intake of cadmium is similar with other Italian and European populations. They also suggest that cadmium intake could influence the levels of metabolic and other biochemical factor which are important risk factors for chronic cardiovascular and endocrine system diseases.

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