

Cadmium dietary intake in a Northern Italy population

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Background

Cadmium (Cd) is an ubiquitous toxic heavy metal. The International Agency for Research on Cancer (IARC) has classified Cd as a human carcinogen (Group I) mainly on the basis of occupational studies. Recent epidemiological studies have shown a direct association between Cd exposure and risk of cancer at several sites (lung, endometrium, bladder and breast) also in the general population. Main source of exposure to Cd, except for smokers and for occupationally-exposed individuals, is food. The highest concentrations of Cd are generally found in products such as seaweed, fish and seafood, chocolate, mushrooms, oilseeds and edible offal, while food groups that mainly contribute to dietary exposure to Cd, as a result of high consumption, are cereals and cereal products, vegetables, nuts, potatoes and meat products. The average Cd intake from food generally varies between 8 and 25 µg/day (more than 80% from cereals and vegetables). Limited evidence about current main sources of Cd intake in the Italian population, however, is available.

Methods

We investigated Cd dietary intake in 719 residents of Bologna, Ferrara, Modena, Parma and Reggio Emilia, five provinces of Emilia Romagna region in northern Italy. We used a validated food frequency questionnaire specifically developed as a part of the European Prospective Investigation into Cancer and Nutrition (EPIC) study specific for the Northern Italy population. The EPIC questionnaire was designed to capture habitual diet/eating behaviors during the past 12 months. Participants were asked to respond to 248 questions about 188 different food items, including seasonal foodstuffs, and to indicate the number of times a given item was consumed (per day, week, month, or year), from which the absolute frequency of consumption of each item was calculated. The quantity of food consumed was assessed by selecting an image of a food portion or selection of a predefined standard portion when no image was available. The food items were then linked to the Italian Food Tables to obtain estimates of Cd dietary intake. We identified also the food categories or single foods which gave a major contribution to Cd intake.

Table 1. Annual average Cd dietary intake (µg/kg body weight/week)

	n	(%)	Mean±SD (min-max)
All subjects	719	(100.0)	1.39±0.8 (0.16-5.62)
Gender			
Men	319	(44.4)	1.34±0.7 (0.20-5.62)
Women	400	(55.6)	1.44±0.8 (0.16-5.20)
Age (years)			
<30	15	(2.1)	1.72±0.7 (0.68-2.99)
30-49	257	(35.7)	1.52±0.8 (0.34-5.20)
50-69	327	(45.5)	1.34±0.7 (0.16-4.34)
≥70	120	(16.7)	1.23±0.9 (0.19-5.62)
Province			
Bologna	198	(27.5)	1.37±0.8 (0.16-5.20)
Ferrara	93	(12.9)	1.45±0.7 (0.40-4.12)
Modena	234	(32.6)	1.38±0.8 (0.19-5.62)
Parma	57	(7.9)	1.34±0.7 (0.36-4.59)
Reggio E.	137	(19.1)	1.43±0.7 (0.24-3.75)
Usual consumer of mushrooms*	12	(1.7)	3.1±0.9 (1.95-4.63)

* More than twice a week

Results

Annual average Cd intake was 1.39 µg/kg body weight/week, with a higher value in females than in males (1.44 and 1.33 µg/kg body weight/week respectively, P=0.07) (Table 1). These values are lower than those reported for the whole European population of 2.5 µg/kg body weight/week, and they are unequivocally below to the limit of 7 µg/kg established by the Joint FAO/WHO Expert Committee on Food. Food categories which gave the major contribution to Cd intake were mushrooms (30.6%), rice (16.9%), pasta (7.6%), bread (6.1%), leafy vegetables (5.3%) and shellfish (4.2%). A higher Cd exposure characterized usual consumers of mushrooms (more than twice/week), whose intake was 3.1 µg/kg body weight/week (Table 2).

Table 2. Food categories which gave the major contribution to Cd dietary intake

Food	Cd intake
Mushrooms	30,6%
Rice	16,9%
Pasta	7,6%
Bread	6,1%
Leafy vegetables	5,3%
Shellfish	4,2%

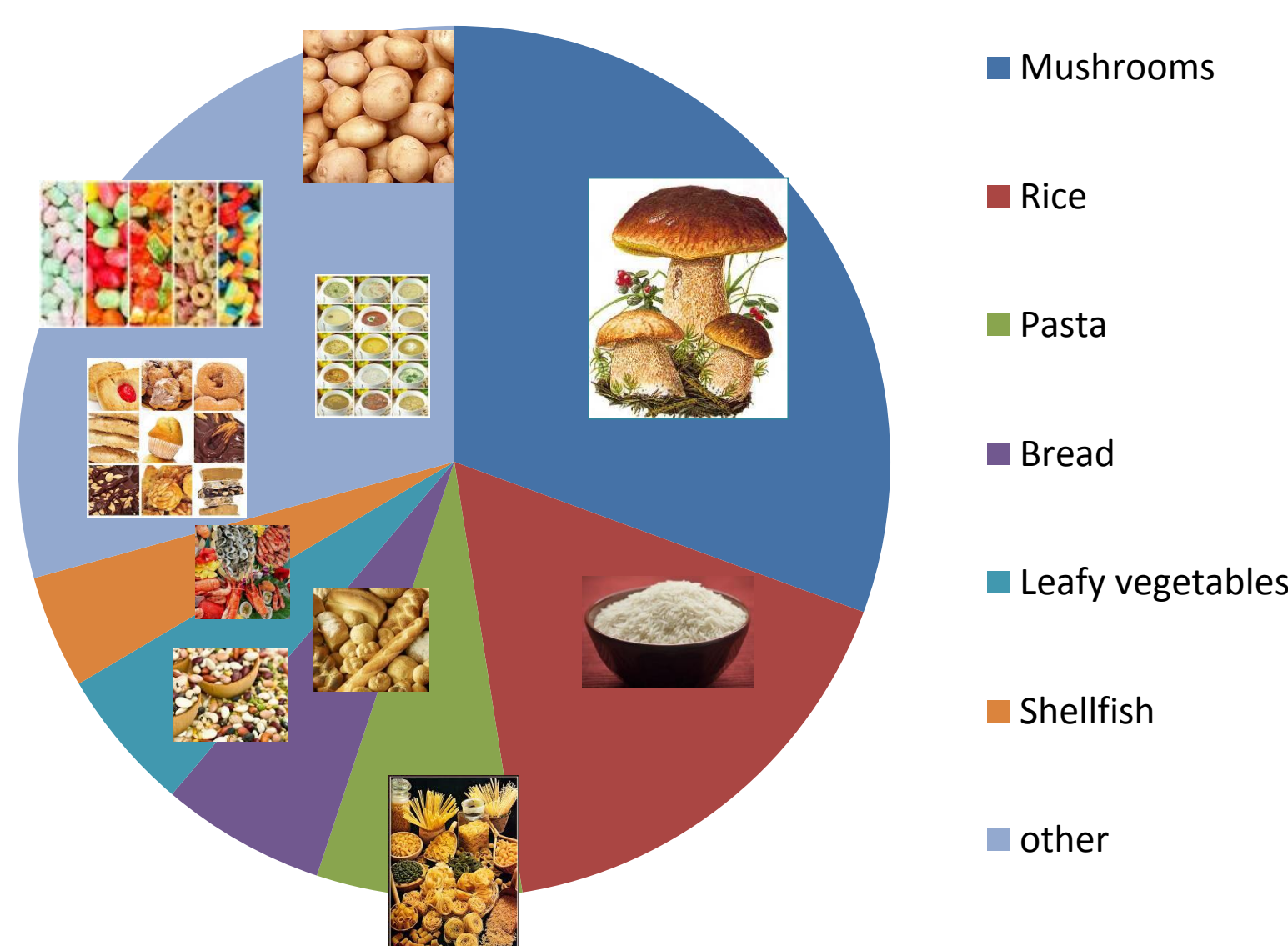
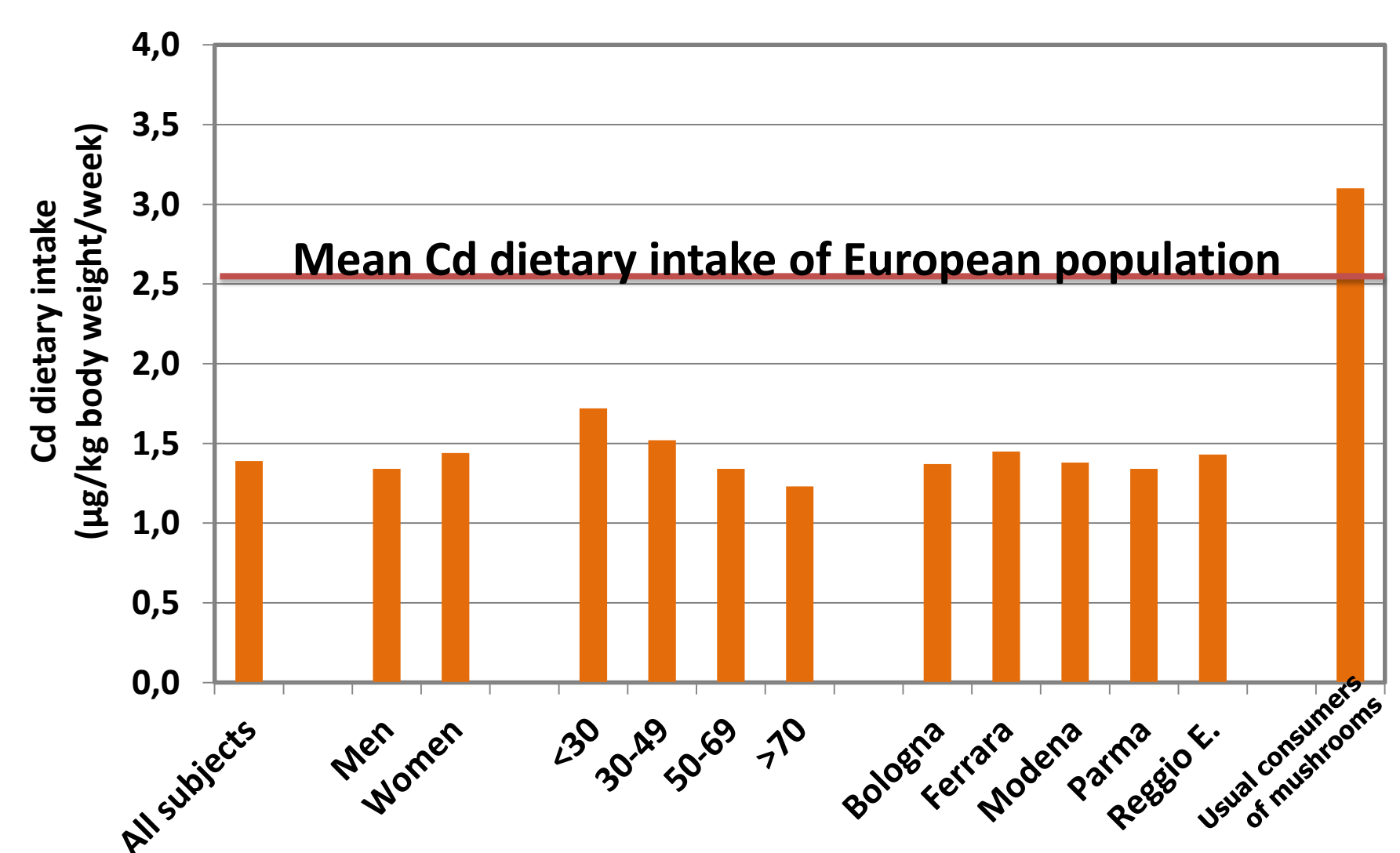


Figure 1. Epic Food Frequency Questionnaire for the assessment of Cd intake



Figure 2. Provinces included in the study



Graphic 1. Annual average Cd dietary intake (µg/kg body weight/week)

Conclusions

Our analysis suggests that cadmium exposure to this northern Italy population is lower than that expected on the basis of the European average intake. However, a high consumption of some specific food items (mushrooms and shellfish) can considerably increase cadmium intake.