

P50

Dietary exposure estimates to fifteen trace elements in an adult population of Emilia Romagna region, Northern Italy

¹Tommaso Filippini*, ¹Stefano Tancredi, ¹Carlotta Malagoli, ¹Marcella Malavolti, ¹Luciano Vescovi, ¹Annalisa Bargellini, ^{1,2}Marco Vinceti

Background and aim

The health effects and the exposure levels of trace elements in humans are important public health topics. Assessing their dietary intake is fundamental to evaluate the long-term risks for public health and for food safety assessment. Since a priority of food safety regulatory agencies is to ensure the protection of consumers

and to assess the health risks for the general population, the estimation of actual dietary intake of trace elements for comparison with tolerable levels is a very important public health topic. In this study, we aimed to evaluate the daily dietary intake of fifteen trace elements in an Italian community of Emilia Romagna region.

Methods

We assessed dietary habits of a Norther Italian community though the validated EPIC questionnaire, a semi-quantitative food frequency questionnaire (FFQ) specifically developed for the Central-Northern Italy population. We collected food samples during the period from October 2016 to February 2017, and we measured trace elements content using inductively coupled plasma-mass spectrometry. We then reported the concentrations of investigated

trace elements according to the food consumption patterns and food categories typical of this Italian population, as assessed though the EPIC FFQ. We combined data on the estimated trace elements in foods and the subjects' dietary habits (Table 1) to compute total daily trace element intake using the equation in Box 1. Accordingly, we estimated the dietary intake of the selected trace elements by reporting median and interquartile ranges of intake.

Foods (g/day)	All (N=719)	Men (N=319)	Women (N=400)
Cereals and cereal products	188.5 (99.3)	206.5 (104.6)	174.2 (92.5)
Meat and meat products	128.4 (70.9)	142.4 (73.5)	117.2 (66.8)
Milk and dairy products	230.7 (216.3)	203.1 (191.9)	252.7 (231.8)
Eggs	15.1 (11.4)	14.6 (11.2)	15.4 (11.5)
Fish and seafood	35.1 (28.1)	35.5 (26.8)	34.9 (29.0)
Vegetables, legumes, potatoes	204.0 (111.6)	201.6 (106.1)	205.8 (115.9)
Fresh fruits	344.3 (220.7)	336.5 (212.3)	350.4 (227.3)
Dry fruits, nuts and seeds	1.7 (3.0)	1.8 (2.9)	1.6 (3.0)
Sweets, chocolate, cakes, etc.	86.5 (73.8)	82.9 (77.3)	89.4 (70.8)
Oils and fats	27.2 (13.5)	27.9 (12.7)	26.7 (14.1)
Beverages	363.3 (295.1)	412.0 (278.8)	324.6 (302.2)

Table 1. Food intake (g/day) according to different food categories for the whole study population and by sex.


$$Daily\ dietary\ exposure\ \left(\frac{\mu g}{day}\right) = \sum \frac{element\ food\ content\ \left(\frac{\mu g}{kg}\right) \times food\ intake\ \left(\frac{g}{day}\right)}{1000}$$

Box 1. Equation for trace element daily intake estimation

Results

We collected a pooled sample of 908 foods. Overall, study results showed that in our population the dietary exposure levels to selected trace elements could be considered similar to that observed in other European and non-European populations. Although we cannot rule out the possibility that the dietary exposure

estimates in the present study may not be representative of the population as a whole, our results provide an accurate and updated assessment of trace elements contamination in food and of their intake far frequently evaluated in a sample of Italian adult consumers from the Emilia Romagna region.

 *Corresponding author: Dr. Tommaso Filippini, Department of Biomedical, Metabolic and Neural Sciences, Section of Public Health - University of Modena and Reggio Emilia, Via Campi, 287 – 41125 Modena. tommaso.filippini@unimore.it

Food	50 th	(IQR)	95 th	95 th pro kg bw ^a	TDI pro kg bw ^a
Antimony (µg/day)	3.47	(2.80-4.39)	6.22	0.089 µg	0.4 µg
Barium (mg/day)	0.84	(0.62-1.12)	1.67	0.024 mg	0.2 mg
Beryllium (µg/day)	0.24	(0.18-0.32)	0.46	0.006 µg	2 µg
Boron (mg/day)	2.04	(1.51-2.76)	4.02	0.056 mg	0.16 mg
Cobalt (µg/day)	19.68	(14.82-25.17)	36.40	0.537 µg	NA
Lithium (µg/day)	18.15	(14.64-22.87)	32.10	0.460 µg	20 µg
Molybdenum (mg/day)	0.20	(0.15-0.26)	0.42	0.006 mg	0.01 mg
Nickel (µg/day)	130	(102-168)	256	3.873 µg	2.8 µg
Silver (µg/day)	0.91	(0.68-1.15)	1.75	0.025 µg	5 µg
Strontium (mg/day)	1.93	(1.54-2.39)	3.32	0.050 mg	0.6 mg
Tellurium (µg/day)	2.70	(1.32-3.75)	5.99	0.084 µg	NA
Thallium (µg/day)	0.53	(0.41-0.68)	1.00	0.015 µg	0.07 µg
Titanium (mg/day)	0.88	(0.70-1.14)	1.66	0.024 mg	0.4-5.0 mg
Uranium (µg/day)	0.79	(0.60-1.12)	1.82	0.027 µg	0.6 µg
Vanadium (µg/day)	10.36	(7.82-13.43)	18.84	0.270 µg	0.2 mg

Table 2. Dietary daily intake of trace elements with median, interquartile range (IQR), and upper 95 percentile (95th) values in µg or mg per day. ^aValues in µg or mg as indicated pro kg of body weight (bw) per day; NA: not assessed.

	Foods presenting the highest TE content	Foods with highest contribution to TE intake
Antimony	Sweets, meat, fish & seafood, and dry fruits	Fresh fruits, cereals, meat, and vegetables
Barium	Cereals, dry fruits, legumes, and, sweets	Milk & dairies, cereals, fresh fruits and vegetables
Beryllium	Legumes, dry fruits, sweets and cereals	Vegetables, cereals, beverages, and fresh fruits
Boron	Dry fruits, legumes, fresh fruits, and vegetables	Fresh fruits, beverages, vegetables, and legumes
Cobalt	Legumes, dry fruits, potatoes and cereals	Vegetables, sweets, beverages, and cereals
Lithium	Fish & seafood, legumes, cereals, and potatoes	Vegetables, cereals, fresh fruits, and beverages,
Molybdenum	Legumes, cereals, sweets, and dry fruits	Cereals, legumes, vegetables, and milk & dairies
Nickel	Dry fruits, legumes, cereals and sweets	Cereals, legumes, fresh fruits, and sweets
Silver	Dry fruits, fish & seafood, cereals, and potatoes	Cereals, fresh fruits, fish & seafood, and vegetables
Strontium	Dry fruits, milk & dairies, legumes, and vegetables	Vegetables, fresh fruits, cereals, and milk & dairies
Tellurium	Dry fruits, milk & dairies, fish & seafood, and meat	Milk & dairies, oils & fats, meat and fresh fruits
Thallium	Dry fruits, eggs, sweets, and vegetables	Vegetables, meat, cereals, and fresh fruits
Titanium	Dry fruits, milk & dairies, sweets, and legumes	Milk & dairies, meat, cereals, and sweets
Uranium	Fish & seafood, sweets, cereals, and milk & dairies	Cereals, beverages, vegetables, and sweets
Vanadium	Legumes, sweets, cereals, and fish & seafood	Vegetables, cereals, beverages, and sweets

Table 3. Foods and beverages presenting the highest content and the highest contribution to dietary intake of investigated trace elements (TE).

Discussion

Overall, our results show that in our relation to excess or deficiency. Though population the dietary exposure levels to we cannot rule out the possibility that selected trace elements could be the dietary exposure estimates in the considered similar to that observed in present study may not be representative of other European and non-European the whole Italian population, they are populations and generally within the and accurate and updated assessment safe range as far as indicated by of trace elements far frequently national and international agencies. This evaluated in a sample of Italian adult suggests that our population should not consumers from the Emilia Romagna be at risk of adverse health effects in region.