

THE FDA'S TOTAL DIET STUDY - TRENDS IN ELEMENT INTAKE

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The Food and Drug Administration's (FDA's) Total Diet Study is a yearly program which monitors the levels of over 200 pesticide residues and industrial chemicals, seven radionuclides (Sr-90, Cs-137, I-131, Ru-106, K-40, Ra-226, Pt-236), five toxic elements (As, Br, Cd, Pb, Hg), and 11 nutritional elements (Na, K, Ca, P, Mg, Fe, Zn, Cu, Mn, Se, I) in representative diets of specific age-sex groups.(1) The program began in 1961 with emphasis on Sr-90, Cs-137, and pesticides; nutritional elements were routinely included by 1974. Data from 1974 to 1982 were obtained by analysis of food commodity groups and were specified for three age categories - adult men, 6 month-old infants, and 2 year-old children.(2) These data indicated that the adult male diet was adequate in most nutritional elements evaluated, but was somewhat low in zinc and copper and elevated in iodine and sodium. The infant diet was low in iron and copper and high in iodine and sodium. The toddler diet was also low in iron and copper and a bit low in zinc and elevated in iodine and sodium. The adult male diet included discretionary salt, but the infant and toddler diets did not. Analysis of yearly data from 1974 to 1982 indicated significant differences in nutrient levels among some years, but no apparent trends.(2)

Since 1982, the foods collected in the Total Diet Study have been analyzed individually, rather than in commodity groups, and the results for daily nutrient or substance intake have been reported for eight age-sex groups including infants, 2 year-old children, 14-16 year-old boys and girls, 25-30 year old men and women, and 60-65 year-old men and women.(1) Data from 1982 to 1984 have been reported (3); this paper summarizes the data from 1982 to 1986.

Between April 1982 and April 1986 there were 16 Total Diet Study food collections. The four collections of each year were obtained (one each) from the four geographic areas of the United States (U.S.) (east, south, central, and west) and sent to the Total Diet Laboratory in Kansas City, MO. For each collection, the 234 Total Diet Study foods (4,5) were purchased from grocery stores and fast food restaurants in three cities in the specified geographic area. Food preparation and/or cooking were done at an institutional kitchen under contract with the Total Diet Laboratory. Deionized water was used for food preparation and cooking, and stainless steel utensils were used for cooking. The like foods from the three cities were composited and homogenized. Aliquots of each composite food were then analyzed for 11 essential elements.

Sodium, potassium, calcium, phosphorus, magnesium, iron, zinc, copper, and manganese were determined by inductively coupled plasma spectrometry (6); a colorimetric method was used for iodine determination (7); and selenium was determined by atomic absorption spectrometry with rapid hydride evolution.(8) Fifteen to 30 food test samples were analyzed in a series. A blank, a spiked test sample, a standard reference material for each element, and at least one test portion in duplicate were analyzed with each series. Unusual values for blanks, standard reference materials, spiked test samples, or duplicates required repetition of the entire series. If the analysis for one or more of the 11 elements gave a result that exceeded previously set upper limits, the test sample was reanalyzed.

The means and standard deviations of the element levels in the 234 foods were determined using the Statistical Analysis System (SAS).(9) Of the 40,625 analyses, results for 67 (0.16%) were identified as outliers by means of the Grubbs studentized extreme deviation test.(10) Means and standard deviations were recalculated omitting the outliers. Average daily intakes of the elements were estimated for eight age-sex groups (4,5) as

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4. Pennington, J.A.T. Revision of the Total Diet Study food list and diets. J Am Diet Assoc 82: 166, 1983.
5. Pennington, J.A.T. Documentation for the Revised Total Diet Study: Food list and diets. No PB 82-192154. Springfield, VA. National Technical Information Service. 1982.
6. Marts, R.W., Meloan, C.E. Rapid digestion/determination of food composites by ICP. Department of Health and Human Services Sarap Report. Vol 6, No 105-79, 1982.
7. Luchtefeld, R.G. Semi-automated method for the determination of iodine in Total Diet market baskets. FDA Lab Inform Bull No 1678. March 12, 1974.
8. Fiorino, J.A., Jones, J.W., Caper, S.G. Sequential determination of arsenic, selenium, antimony, and tellurium in foods via rapid hydride evolution and atomic absorption spectrometry. Anal Chem 48: 123, 1980.
9. Helwig, J.T., Council K.A. SAS User's Guide. Cary, NC. SAS Institute. 1979.
10. Grubbs, F.E. Procedures for detecting outlying observations in samples. Technometrics 11:1, 1969.
11. Food and Nutrition Board. Recommended Dietary Allowances, 9th rev ed Washington DC. National Academy of Sciences. 1980.