CONCENTRATION OF STABLE ELEMENTS IN FOOD PRODUCTS

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ABSTRACT

Food samples were taken from commercial markets and analyzed for stable element content. The concentrations of most stable elements (Ag, Al, As, Au, Ba, Br, Ca, Ce, Cl, Co, Cr, Cs, Cu, Fe, Hf, I, K, La, Mg, Mn, Mo, Na, Rb, Sb, Sc, Se, Sr, Ta, Th, Ti, V, Zn, Zr) were determined using multiple-element neutron activation analysis, while the concentrations of other elements (Cd, Hg, Ni, Pb) were determined using atomic absorption. The relevance of the concentrations found are noted in relation to other literature values.

The 1977 study has been extended to include the determination of the concentration of stable elements in home-grown products in the vicinity of the Oak Ridge National Laboratory. Comparisons between the commercial and local foodstuff values are discussed.

INTRODUCTION

The objective of this study was to determine the concentrations of stable elements in food grown locally and in food obtained from commercial markets. Analyses were conducted on various commercially available foodstuffs found in a typical southerner's diet; the results were published by Oakes, et al. (12) and are given in Tables 1 and 2.

In 1979, the program was extended to include home-grown vegetables: corn, tomatoes, green beans, and potatoes. The objective of this program was to collect data for comparison to commercially available products. Investigations of stable elements in foodstuffs grown in the Oak Ridge area will be repeated annually.

PROCEDURES

Food samples, commonly found in southerners' diets, were purchased from supermarkets within the Knoxville/Oak Ridge area. Home-grown vegetables were collected from individuals within the local populations and surrounding areas of Oak Ridge National Laboratory.

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DISCLAIMER

PREPARATION OF FOOD SAMPLES FOR ANALYSES

Food samples were prepared for ashing according to their water contents. Samples with high water content (melons, canned fruits, etc.) were homogenized in a blender. Meats, vegetables, dry food products, and other samples with low water content were chopped into small pieces. Samples were dried in a muffle furnace overnight at 150°C. The time and temperature depended on the water contents of samples; i.e., the time intervals at a given temperature for meats and vegetables were longer than the time intervals at the same temperature for dry milk, spaghetti, and rice.

The authors recommend that the temperature be increased at 100 C° intervals for at least one hour for dry products; and the maximum temperature not exceed 450°C. If 450°C is exceeded, the possibility of volatilization of elements will increase.

Atomic Absorption Spectroscopy Method-

Wet portions of samples were analyzed for mercury using a wet ashing procedure. The procedures used to analyze for mercury are the same as those used by Cyrus Feldman (5). A two-gram sample of the ashed food was analyzed for Cd, Ni, and Pb. The ashed samples were dissolved in concentrated nitric acid and analyzed by flameless atomic absorption spectroscopy using a Perkin Elmer 503 Spectrophotometer with a Model 2100 Heated Graphite Atomizer System.

Neutron Activation Method

A one-gram ash sample was analyzed for stable element concentrations (Ag, Al, As, Au, Ba, Br, Ca,Ce, Cl, Co, Cr, Cs, Cu, Eu, Fe, Hf, I, K, La, Mg, Mn, Mo, Na, Sb, Sc, Se, Sr, Ta, Te, Th, Ti, V, Zn, Zr) by multi-element neutron activation analysis. Samples were irradiated in the Oak Ridge Research Reactor and counted with a Ge(Li) Detector and Nuclear Data PDP-15 Analyzer Computer System. The counting times were determined by the half-lives of the elements being analyzed. The presence of elements with short half-lives were determined by irradiating samples for 30 seconds and counting immediately. The intensity, radiation build-up, and decay period of an isotope are functions of the isotope's half-life. If the isotope has a short half-life, the intensity is extreme and the radiation build-up and decay were rapid. The intensity of an isotope with a longer half-life was less extreme and the radiation build-up and decay were longer. For isotopes with long half-lives, after the initial count, the samples were re-irradiated for 30 minutes, stored for one week, counted, stored for another week, and recounted for the final time.

RESULTS AND DISCUSSIONS

Knowledge of trace elements in the diet dates back several hundred years to the discoveries of iron and iodine requirements as discussed in the review paper by Wolf (15). The necessities of Cu, Mn, Zn, Co, Mo, Se, and Ca were discovered years later. There are other elements such as Sn, V, F, Si, and As which have been discovered but their roles in the biological system are not clear. Therefore, trace elements have been divided into several categories (9).

(1) Trace elements in food which have well defined human requirements (Fe, Zn, I, Ca, Mg, and Na).

(2) Trace elements which exist in food but the human requirements have not been quantified (Cr, Mn, Cu, Se, and Mo).

(3) Trace elements in food which are required by animals but the required human requirements are uncertain (Si, V, As, Sn, and Cd).

(4) Trace elements in food which are required by plants (B and Si) but the roles they play in the human body are unknown.

The difficulties of analyses, the amount ingested, the biological effectiveness of the form of the elements ingested, and other factors in the diet have affected the proper assessments of trace elements (3,9).

The results of this study (Tables 3,4,5, and 6) were compared to results found in the literature. It was interesting to note the variations in the results reported for the micronutrients (Na, K, Ca, P, Mg, Fe, I, F, Zn, Cu, and Co). For information on the principle sources, functions, deficiencies, toxicities, and therapeutic dosages of these elements, consult Berkow and Talbott (2). The greatest variations were observed for several essential micronutrients (Mg, Ca, and Zn) found in tea. Gormican (7) and ORNL observed values of 4650 μg/g wet wt. and 1300 μg/g wet wt. for Ca; and values of 1920 μg/g wet wt. and 3100 μg/g wet wt. for Mg, respectively. The values observed by Gormican (7) were 3.6 times higher than this laboratory value for Ca and 1.6 times lower than this laboratory value for Mg. Other variations were observed for the Zn content in tea. Gormican (7), Murphy (10), Freeland-Cousin (6) and ORNL observed 54 μg/g wet wt., 33 μg/g wet wt., 0.6 μg/g wet wt., and 18 μg/g wet wt., respectively. The values observed for the Zn content in tea by Freeland and Cousin (6) were 9 times lower than this study's value. The difference may be due to the brand of tea analyzed and the methods of preparation. Gormican (7) analyzed tea in bags; Murphy (10) analyzed dry tea leaves while Freeland-Cousin (6) and this laboratory analyzed instant tea. The value reported in this study for the Ca content of peanut butter (2700 μg/g wet wt.)was considerably higher than the values reported by Gormican (340 μg/g wet wt.) (7).

The functions of trace elements such as Cd, Hg, and U are unclear. The data obtained in this study indicate that oysters supply the human diet with Cd, Hg, and U. A high concentration of Hg is introduced into the diet by fish (especially tuna fish) (1,4,8). The average amount of Cd, Hg, and U ingested is less than 1 μg/g wet wt. (0.05, 0.01, and 0.02, respectively). The total amount of these elements ingested from an average diet ranges from 1.7 μg/day (U) to 106 μg/day (Cd). The total amount of Hg ingested from an average diet is 27 μg/day. Twenty-seven μg/day is also the average amount of Hg ingested by an Oak Ridge resident (on an average diet); the amount of Hg ingested varies according to the diet. An individual on an 8 oz. of tuna/day weight watcher diet will ingest 70 μg of Hg/day from the tuna. This amount exceeds the tolerable limit of Hg which is 43μg/da (11). The amount of U in the diet has been estimated to be 1.3 μg/day for individuals in New York City and San Francisco, 1.4 μg/day for Chicago, and 1.7 μg/day for Oak Ridge (12, 14). The average amount of U in the human diet as indicated by Schroeder (13) is 1.3 μg/day.

Other observations include the variations in values observed for fresh and canned vegetables (corn and tomatoes). The data indicate that fresh vegetables have higher concentrations of K and Zn while canned vegetables are higher in Cl, Cu, and Na. The trace elements Sc and U are higher in fresh vegetables but the values observed are less than 1 μg/g wet wt. As, Au, Cs, Pb, Se, and V concentrations are higher in canned vegetables, however, the values observed are less than 1 μg/g wet wt.

Extensive research has been conducted on Al, Ba, B, Ca, Cr, Cu, Fe, I, Mg, Mn, P, K, Se, Na, and Zn contents in various foods or the total diet (6, 7, 10, 13). Limited data are available on the Sb, As, Cd, Co, Hg, Mo, Ni, Pb, and Sn contents in the human diet. Data may be available on other elements,however, they are not as extensive as data on the micronutrients and other trace elements.

CONCLUSION

There was a slight difference observed in the concentration of stable elements between commercially and locally grown food products. Many trace elements were found in this study that were not found by others.

Incorporated in this paper are data from the original foodstuff project conducted by T. W. Oakes, et al, (12) and data obtained since that time. The authors are pleased with the quantity of available information on the micronutrients but suggest that further research be conducted on the concentrations of trace elements in foodstuffs.

Table 1. Stable element composition of fresh fruits and vegetables

Foodstuff	Ash wt. / wet wt.	μg/g (wet wt.) Ag	Al	As	Au	Ba	Br	Ca	Ce	Cd	Cl	Co	Cr	Cs	Cu	Eu	Fe	Hf	I	K
Vegetables																				
Cucumbers	5.8(-3)	<2.9(-3)	2.6(-1)	6.4(-3)	4.1(-5)	<5.8(-1)	8.7(-2)	34	<5.8(-3)	4.5(-4)	1.3(2)	8.7(-4)	6.4(-3)	<4.1(-4)	<4.4(-1)	<2.9(-4)	9.5(-1)	<5.8(-4)	<2.3(-2)	5.9(2)
Turnips	6.7(-3)	<6.2(-3)	1.2	<1.0(-2)	7.6(-5)	4.3(-1)	1.6(-1)	1.1(2)	3.0(-3)	9.0(-4)	1.2(2)	5.6(-3)	9.9(-3)	3.3(-3)	3.3(-1)	<3.1(-4)	1.0	3.7(-4)	<2.0(-2)	5.7(2)
Cabbage	8.0(-3)	<8.0(-3)	1.5	<1.6(-2)	4.0(-4)	1.3	3.7(-1)	40	6.4(-3)	2.1(-3)	2.0(2)	3.6(-3)	1.3(-3)	<4.2(-3)	<4.0(-1)	<4.0(-1)	2.4	<4.8(-4)	<3.2(-2)	1.8(3)
Yellow squash	7.3(-3)	<7.3(-3)	1.0	<7.3(-3)	2.4(-5)	<7.3(-1)	1.6(-1)	47	<7.3(-3)	4.3(-4)	1.1(2)	7.9(-4)	8.0(-3)	<4.7(-4)	1.9(-1)	<3.7(-4)	8.0(-1)	<4.0(-4)	1.8(-2)	4.5(2)
Carrots	8.8(-3)	<7.5(-3)	4.0(-1)	<1.3(-2)	<1.0(-4)	1.4(-1)	8.5(-2)	25	<7.5(-3)	1.9(-3)	1.8(2)	3.0(-3)	1.8(-2)	<4.0(-4)	2.2(-1)	<3.8(-4)	7.6(-1)	2.4(-1)	2.5(-2)	7.6(2)
Sweet potatoes	1.2(-2)	<1.2(-2)	2.7	<3.6(-2)	ND[a]	1.4	6.4(-1)	1.3(2)	1.2(-2)	1.0(-3)	2.3(2)	2.4(-3)	1.8(-2)	2.9(-3)	8.8(-1)	<1.2(-3)	4.3	1.1(-3)	<4.8(-2)	1.9(3)
Green peppers	6.4(-3)	<6.4(-3)	1.2(-1)	<6.4(-3)	ND	1.9(-1)	6.6(-2)	12	<3.2(-3)	3.8(-4)	20	2.6(-3)	6.4(-3)	2.6(-4)	7.0(-2)	<3.2(-4)	4.3(-1)	<3.2(-4)	<6.4(-3)	1.6(2)
Green beans	6.7(-3)	<3.4(-3)	3.6(-1)	<6.7(-3)	ND	<4.0(-1)	6.2(-2)	68	<6.7(-3)	1.5(-4)	36	1.0(-3)	8.7(-3)	<3.4(-4)	1.5(-1)	<3.4(-4)	7.4(-4)	<3.4(-4)	<1.3(-2)	2.7(2)
Irish potatoes	9.9(-3)	<5.0(-3)	3.8	<9.9(-3)	ND	<6.9(-1)	6.0(-2)	18	<9.9(-3)	5.2(-3)	49	2.5(-3)	1.8(-2)	2.0(-3)	3.8(-1)	<5.0(-4)	2.8	5.0(-4)	<2.0(-2)	6.9(2)
Egg plant	6.8(-3)	ND	6.4(-1)	<6.7(-3)	<5.1(-5)	<6.7(-1)	2.1(-1)	26	ND	4.2(-3)	88	3.7(-4)	1.5(-2)	<1.7(-4)	1.7(-1)	ND	6.8(-1)	ND	<1.7(-2)	6.1(2)
Lettuce	5.3(-3)	ND	1.0(-1)	<5.3(-3)	<5.8(-6)	<5.3(-1)	1.6(-2)	17	ND	1.2(-3)	44	5.3(-4)	8.0(-3)	1.6(-4)	<1.1(-1)	ND	3.4(-1)	ND	<1.1(-2)	1.7(2)
Broccoli	1.1(-2)	ND	8.1(-1)	<1.1(-2)	<5.5(-5)	<1.1	2.8(-1)	1.2(2)	ND	2.2(-3)	99	6.8(-3)	1.4(-2)	<6.6(-4)	5.7(-1)	ND	1.6	ND	<3.3(-2)	7.0(2)
Fruits																				
Winesap apples	5.4(-3)	ND	4.4(-2)	<5.4(-4)	4.9(-6)	5.9(-2)	1.5(-3)	7.2	ND	2.2(-5)	4.9(-1)	3.2(-4)	7.6(-3)	<1.1(-4)	2.3(-2)	ND	5.5(-1)	ND	<2.7(-3)	1.0(2)
Sunkist oranges	6.7(-3)	ND	1.4	<5.2(-3)	<6.7(-5)	<1.7(-1)	4.0(-2)	98	ND	6.6(-5)	22	4.3(-4)	1.5(-2)	<4.6(-4)	1.1(-1)	ND	2.2	ND	<1.0(-2)	5.9(2)
Bananas	1.4(-2)	ND	1.4	<1.4(-4)	<1.4(-4)	<1.4(-1)	1.1(-1)	15	ND	8.4(-5)	92	8.4(-4)	3.5(-2)	<5.6(-4)	4.5(-1)	ND	1.9	ND	<2.8(-2)	1.5(3)
Tangelos	1.2(-2)	ND	5.0(-1)	<1.2(-2)	<1.9(-5)	<1.2(-1)	1.1(-1)	1.4(2)	ND	2.3(-4)	19	8.4(-4)	4.3(-2)	2.9(-3)	2.5(-1)	ND	1.2	ND	<2.4(-2)	1.2(3)
Raisins	2.6(-2)	ND	15	<5.2(-2)	<2.6(-4)	<2.6	1.1	3.6(2)	ND	2.4(-3)	1.1(2)	7.0(-3)	9.9(-2)	1.6(2)	1.3	ND	10.4	ND	<7.8(-2)	3.9(3)
Grapefruits	4.4(-3)	ND	3.1(-2)	<8.8(-4)	2.2(-6)	<8.8(-2)	1.5(-2)	15	ND	1.4(-3)	3.5	4.4(-5)	5.3(-3)	<8.8(-5)	2.8(-2)	ND	3.2(-1)	ND	<4.4(-3)	1.1(2)
Pears	5.7(-3)	ND	9.1(-2)	<1.1(-3)	1.1(-5)	9.1(-2)	4.0(-3)	20	ND	2.8(-6)	1.0	3.4(-3)	1.0(-2)	<2.3(-4)	1.5(-1)	ND	1.8	ND	<5.7(-3)	3.0(2)
Golden Delicious Apples	4.2(-3)	ND	9.2(-2)	<2.1(-4)	3.8(-6)	2.4(-2)	6.7(-4)	3.4	ND	7.6(-5)	2.9(-1)	8.4(-5)	5.0(-3)	1.7(-4)	3.2(-2)	ND	3.6(-1)	ND	<4.2(-3)	64
Red Delicious Apples	2.0(-3)	ND	1.5(-2)	<1.0(-4)	1.2(-6)	<8.0(-3)	1.2(-4)	9.8(-1)	ND	5.4(-5)	6.2(-2)	4.0(-5)	3.2(-3)	<2.0(-5)	5.0(-3)	ND	8.4(-2)	ND	<1.0(-3)	20

[a]Nondetectable.

Table 2. Stable element composition of fresh fruits and vegetables

Foodstuff	La	Mg	Mo	Mn	Na	Ni	Pb	Rb	Sb	Sc	Se	Sr	Ta	Te	Th	Ti	V	Zn	Zr
	μg/g (wet wt.)																		
Vegetables																			
Cucumbers	1.2(−2)	35	<8.7(−2)	3.2(−1)	9.2	1.3(−2)	2.4(−2)	7.0(−2)	<3.5(−4)	1.6(−5)	<5.8(−3)	<1.2	<2.9(−4)	1.3(−1)	4.7(−3)	<4.6(−1)	<5.8(−3)	5.1(−1)	<2.3(−1)
Turnips	4.7(−3)	36	6.5(−2)	3.0(−1)	22	2.9(−2)	5.9(−3)	4.7(−1)	7.4(−4)	1.6(−4)	5.2(−3)	1.3	<2.6(−4)	4.6(−1)	4.9(−3)	5.1(−1)	4.8(−3)	4.2(−1)	<3.1(−1)
Cabbage	<5.6(−3)	22	<9.9(−2)	1.2	38	4.9(−2)	1.6(−2)	4.6(−1)	<4.3(−3)	<8.0(−5)	<8.0(−3)	<2.2	<4.8(−4)	2.8(−1)	<2.4(−3)	<6.8(−1)	8.0(−3)	5.6(−1)	<4.0(−1)
Yellow squash	<7.3(−3)	35	<9.8(−2)	2.4(−1)	4.0	9.0(−3)	9.7(−3)	7.0(−2)	<4.7(−4)	3.9(−5)	<7.3(−3)	<8.7(−1)	<5.5(−4)	2.6(−1)	2.2(−3)	<3.7(−1)	<7.3(−3)	4.1(−1)	<2.2(−1)
Carrots	<4.3(−3)	30	<8.0(−2)	1.5(−1)	28	2.0(−2)	1.2(−2)	1.1(−1)	<4.0(−4)	5.1(−5)	<5.3(−3)	<1.33	<2.4(−4)	2.8(−1)	<2.3(−3)	<5.3(−1)	<8.8(−3)	4.6(−1)	<3.2(−1)
Sweet potatoes	<2.4(−2)	1.1(2)	<4.8(−1)	1.0	87	3.2(−2)	3.2(−2)	9.2(−1)	4.2(−3)	3.8(−4)	<2.4(−2)	<4.8	<7.2(−4)	5.0(−1)	<4.8(−3)	<1.2	5.2(−3)	1.3	<6.0(−1)
Green peppers	<3.6(−3)	9.4	3.5(−2)	9.1(−2)	2.4	8.1(−3)	1.3(−3)	<5.7(−2)	3.0(−3)	1.2(−5)	<3.8(−3)	1.8(−1)	<1.9(−4)	3.8(−2)	<1.9(−3)	<1.2(−1)	<1.6(−3)	1.0(−1)	<1.3(−1)
Green beans	<6.7(−3)	33	1.0(−1)	2.8(−1)	6.5	2.3(−2)	1.9(−2)	4.7(−2)	<3.4(−4)	<3.4(−5)	<6.7(−3)	4.0(−1)	<3.4(−4)	<3.4(−1)	<2.0(−3)	<2.0(−1)	<3.4(−3)	2.6(−1)	<1.3(−1)
Irish potatoes	<9.9(−3)	45	<1.5(−1)	3.0(−1)	18	4.0(−2)	2.6(−2)	1.1	<6.9(−4)	5.9(−4)	<9.9(−3)	<2.0	<5.0(−4)	4.5(−2)	<4.0(−3)	2.1(−1)	9.3(−3)	2.7(−1)	<3.0(−1)
Egg plant	<6.8(−4)	37	1.3(−2)	2.8(−1)	9.5	2.3(−1)	4.3(−2)	1.2(−1)	<1.4(−4)	1.0(−4)	2.4(−3)	<1.5	<1.0(−4)	<6.8(−2)	ND[a]	<3.4(−1)	6.7(−3)	3.5(−1)	ND
Lettuce	<5.3(−4)	5.8	5.3(−3)	9.9(−2)	4.6	1.2(−2)	1.4(−3)	<2.8(−2)	<1.1(−4)	5.3(−6)	<1.6(−3)	<2.1(−1)	<1.1(−4)	ND	ND	<2.7(−1)	5.3(−3)	1.3(−1)	ND
Broccoli	<2.2(−3)	42	2.1(−2)	9.9(−1)	61	4.6(−2)	1.6(−2)	3.7(−1)	<1.1(−3)	9.9(−5)	<5.5(−3)	<2.2	<2.2(−4)	ND	ND	<5.5(−1)	5.5(−3)	8.1(−1)	ND
Fruits																			
Winesap Apples	<5.4(−4)	4.9	1.1(−3)	2.6(−2)	9.2(−1)	2.5(−3)	1.4(−3)	3.1(−2)	1.6(−4)	5.4(−6)	<1.1(−3)	5.9(−2)	<5.4(−5)	ND	ND	<5.4(−2)	<5.4(−4)	3.2(−2)	ND
Sunkist Oranges	<6.7(−4)	29	<1.4(−2)	5.3(−2)	3.1	7.7(−3)	2.4(−3)	1.6(−1)	<2.7(−4)	1.0(−4)	<3.0(−3)	5.4(−1)	<1.4(−4)	<1.7(−1)	ND	<1.2(−1)	<1.2(−3)	8.7(−2)	ND
Bananas	<1.4(−3)	1.4(2)	2.8(−2)	2.8(−1)	12	6.3(−2)	2.1(−3)	2.4(−1)	1.4(−3)	5.6(−5)	<7.0(−3)	<2.8	<1.4(−4)	ND	ND	<7.0(−1)	<7.0(−3)	7.0(−3)	ND
Tangelos	<1.2(−3)	85	2.4(−3)	2.5(−1)	13	3.0(−2)	2.6(−3)	4.2(−1)	6.0(−4)	1.2(−5)	<2.4(−3)	1.1	<1.2(−4)	<3.6(−1)	ND	<6.0(−1)	<6.0(−3)	4.1(−1)	ND
Raisins	5.7(−3)	1.8(2)	<1.3(−1)	1.3	7.8	1.7(−1)	3.6(−2)	6.1	<1.3(−2)	1.6(−3)	<5.2(−2)	1.8	<1.0(−3)	ND	ND	<1.3	1.6(−2)	ND	ND
Grapefruit	<4.4(−4)	7.9	<2.2(−3)	2.1(−2)	1.4	2.2(−2)	6.5(−3)	1.8(−2)	<1.8(−4)	<2.2(−5)	<8.8(−4)	5.9(−1)	<8.8(−5)	ND	ND	<4.4(−2)	<2.2(−4)	4.4(−2)	ND
Pears	<5.7(−4)	16	<5.7(−3)	1.7(−1)	2.3	2.9(−3)	1.9(−3)	1.1(−1)	2.1(−4)	<2.3(−5)	<1.1(−3)	<4.0(−1)	<1.1(−4)	ND	ND	<1.1(−4)	<2.9(−4)	1.9(−1)	ND
Golden Delicious Apples	<2.1(−4)	3.0	<2.1(−3)	1.9(−2)	1.3	1.9(−3)	2.0(−3)	6.3(−2)	8.4(−5)	1.3(−5)	<1.7(−4)	<8.4(−2)	<1.3(−5)	<1.3(−2)	ND	9.2(−3)	8.4(−5)	2.0(−2)	ND
Red Delicious Apples	<1.0(−4)	8.6(−1)	<4.0(−4)	5.2(−3)	4.2(−1)	4.7(−3)	9.8(−4)	1.4(−2)	2.0(−5)	2.6(−6)	<1.8(−4)	<2.0(−2)	<1.0(−5)	ND	ND	<4.0(−3)	3.0(−4)	ND	ND

[a]Nondetectable.

Table 3. Stable element composition in selected foods

Foodstuff	Ash wt. / Wet wt.	µg/g (wet wt.) Ag	Al	As	Au	Ba	Br	Ca	Ce	Cd	Cl	Co	Cr	Cs	Cu	Eu	Fe	Hf	Hg	I	K
Applesauce	3.0(−3)	<3.0(−3)	6.3(−1)	<9.0(−2)	<3.0(−3)	1.2(−1)	7.3(−1)	2.2(3)	<6.0(−3)	NA[b]	5.4(2)	4.8(−3)	7.8(−2)	1.2(−3)	<1.5	<6.0(−5)	4.8	4.2(−4)	NA	<1.2(−1)	7.5(2)
Beans (Baked)	2.0(−2)	<2.0(−2)	3.0	<1.0	<2.0(−2)	<1.0	8.6(−1)	4.7(2)	<4.0(−2)	1.9(−3)	4.4(3)	1.6(−2)	7.2(−2)	3.2(−3)	<10	<4.0(−4)	29	<2.0(−3)	1.2(−6)	<8.0(−1)	3.0(3)
Beans[c] (Green)	1.4(−2)	6.0(−2)	5.7	<6.9(−3)	4.42(−4)	2.3	6.1(−1)	8.3(−2)	9.7(−3)	9.2(−3)	2.4(2)	8.8(−2)	2.5(−1)	1.1(−3)	1.7	3.4(−4)	1.53(1)	3.45(−3)	ND[a]	2.22(−1)	4.49(3)
Beans (Pinto)	3.6(−2)	<7.2(−2)	6.1	<3.6(−2)	<3.6(−4)	<1.8	5.4(−1)	4.3(2)	<1.1(−1)	1.4(−2)	4.1(2)	2.4(−1)	1.9(−1)	7.2(−3)	7.2	ND	50	<1.8(−2)	1.8(−4)	<3.6(−1)	1.4(4)
Beef (Ground)	9.5(−3)	<9.5(−3)	1.9	<2.9(−1)	<5.7(−3)	<4.8(−1)	1.5	80	<2.9(−2)	1.8(−3)	4.8(2)	–	2.9(−2)	3.5(−3)	<1.4	<9.5(−5)	16	<1.9(−3)	5.0(−5)	<9.5(−2)	2.7(3)
Bologna	3.1(−2)	<3.1(−2)	6.2	3.1	<3.1(−2)	<1.6	2.8	<2.2(2)	6.2(−2)	3.7(−3)	1.3(4)	2.5(−3)	1.1(−1)	9.4(−3)	<31	<6.2(−4)	7.3	<3.1(−3)	<6.0(−5)	1.6	1.6(3)
Bread (White)	1.9(−2)	<1.9(−2)	4.6	<9.5(−1)	<3.8(−3)	8.9(−1)	15	6.8(2)	<3.8(−2)	2.1(−2)	4.0(3)	1.5(−2)	1.1(−1)	6.1(−3)	<15	<3.8(−4)	22	<1.9(−3)	5.7(−4)	<9.5(−1)	<1.1(2)
Bread (Whole Wheat/Rye)	2.6(−2)	ND	11	<3.9(−1)	ND	8.3(−1)	8.8	1.2(3)	2.6(−2)	2.6(−2)	6.2(3)	1.3(−2)	7.5(−2)	5.5(−3)	<26	2.3(−4)	33	<1.3(−3)	<3.6(−5)	<1.3	1.7(3)
Cantaloupe	6.6(−3)	<6.6(−3)	5.1(−1)	<1.3(−1)	<2.6(−3)	ND	6.8(−1)	1.1(2)	<6.6(−2)	NA	5.4(2)	6.6(−3)	1.9(−2)	2.5(−3)	<1.3	<6.6(−5)	1.4	<5.3(−4)	3.5(−4)	6.6(−2)	1.8(3)
Chicken	8.1(−3)	<1.6(−2)	2.4	<8.1(−2)	<8.1(−4)	<1.6	2.7(−1)	1.3(2)	<5.7(−2)	8.9(−3)	16	<2.4(−3)	<5.7(−2)	<8.1(−2)	<1.2	<8.1(−4)	3.2	<4.1(−3)	6.1(−4)	<8.1(−2)	2.8(3)
Coffee	4.0(−2)	<8.0(−2)	1.1(2)	<8.0(−2)	<1.2(−3)	2.3	8.4(−1)	7.6(2)	1.6(−1)	1.9(−3)	1.5(2)	ND	5.2(−1)	6.0(−2)	1.1(1)	2.4(−3)	3.4(2)	7.2(−3)	5.1(−4)	<1.6(−1)	1.3(4)
Corn (Canned)	1.3(−2)	<1.3(−2)	ND	2.9(−1)	<1.3(−3)	<2.6(−1)	1.0	26	<1.3(−2)	8.7(−3)	4.7(3)	2.9(−3)	2.9(−2)	1.2(−3)	<1.3(1)	ND	3.0	<1.3(−3)	9.0(−5)	<6.5(−1)	1.6(3)
Corn[c]	7.48(−3)	1.17(−2)	8.23(−1)	1.52(−2)	1.87(−4)	2.24(−1)	1.1	3.6(1)	6.7(−3)	4.7(−3)	1.5(2)	6.4(−3)	9.0(−2)	4.4(−4)	6.0(−1)	1.5(−4)	4.3	4.5(−4)	ND	6.9(−2)	2.5(3)
Cottage Cheese	1.4(−2)	<2.8(−3)	<2.8	<1.4	<1.4(−2)	<2.8(−1)	9.8(−1)	4.6(2)	<1.4(−2)	2.2(−3)	4.5(3)	7.0(−4)	3.1(−2)	5.6(−4)	<14	<1.4(−4)	4.2(−1)	<8.4(−4)	<8.4(−2)	<7.0(−1)	7.0(2)
Dates	1.5(−2)	<1.5(−2)	7.8	<1.5(−1)	<1.5(−3)	<3.0(−1)	5.6	4.2(2)	<1.5(−1)	NA	2.7(3)	9.0(−3)	8.7(−2)	1.1(−3)	<4.5	<1.5(−4)	8.0	1.1(−3)	2.9(−3)	<4.5(−1)	5.9(3)
Fruit (Canned Mixed)	2.8(−3)	<2.8(−3)	7.7(−1)	<8.4(−2)	2.8(−3)	<2.8(−1)	3.5(−1)	61	<5.6(−3)	2.0(−2)	40	5.3(−3)	5.6(−2)	3.1(−3)	1.0	<1.1(−4)	2.3	<5.7(−4)	<6.0(−5)	1.3(−1)	8.7(2)
Grapes (Green)	4.5(−3)	<4.5(−3)	1.2	<1.8(−2)	2.3(−4)	ND	4.0(−1)	1.1(2)	<4.5(−3)	8.9(−4)	27	3.2(−4)	3.0(−2)	2.7(−3)	1.0	<9.0(−5)	2.1	9.0(−5)	1.6(−3)	<2.7(−2)	1.6(3)
Green Beans (Canned)	1.1(−2)	<5.5(−3)	<5.5	<3.3(−1)	1.1(−3)	2.0(−1)	5.8(−1)	1.3(2)	<3.3(−3)	9.1(−4)	4.2(3)	9.9(−3)	2.1(−2)	6.6(−4)	<11	4.4(−5)	3.4	<2.2(−4)	1.3(−4)	5.5(−1)	7.8(2)
Melon (Honeydew)	5.3(−3)	<2.7(−3)	1.9	<8.5(−2)	<2.7(−3)	ND	3.0(−1)	58	<5.3(−3)	NA	3.2(2)	4.2(−3)	1.2(−2)	5.3(−4)	4.8(−1)	<5.3(−5)	1.2	1.4(−4)	2.6(−4)	<3.2(−2)	1.7(3)
Melon (Water)	2.8(−3)	<2.8(−3)	4.4(−1)	<8.4(−3)	<1.1(−4)	ND	5.0(−2)	17	3.4(−3)	NA	31	4.5(−2)	2.4(−2)	1.3(−3)	2.8(−1)	1.4(−4)	1.6	<2.2(−4)	1.2(−4)	<8.4(−3)	9.8(2)
Milk (Dry)	8.1(−2)	<3.2	6.2	<6.5(−1)	<5.7(−3)	<3.2	12	1.0(4)	<2.4(−1)	NA	9.8(3)	6.6(−3)	2.5(−1)	3.2(−2)	<24	ND	<4.1	<8.1(−3)	9.0(−5)	<2.4	1.4(4)

[a]Nondetectable.
[b]Not Analyzed.
[c]Samples grown in the vicinity of Oak Ridge National Laboratory.

Table 4. Stable element composition in selected foods

Foodstuff	µg/g (wet wt.)								
	La	Mg	Mn	Mo	Na	Ni	Pb	Rb	Sb
Applesauce	<6.0(-2)	66	2.4(-1)	<1.5	2.8(2)	NA[b]	NA	1.5	<9.0(-4)
Beans (Baked)	<6.0(-1)	3.5(2)	2.4	<1.0(1)	2.8(3)	7.0(-1)	1.2(-1)	8.0(-1)	<4.0(-3)
Beans[c] (Green)	1.3(-2)	4.8(2)	7.6	1.6(-1)	8.2	4.3(-1)	8.1(-2)	2.2	8.3(-4)
Beans (Pinto)	<7.2(-3)	1.3(3)	10	1.2	3.1	1.3	3.3(-1)	11	<3.6(-2)
Beef (Ground)	<1.9(-1)	1.9(2)	<3.8(-1)	<2.9	5.1(2)	4.3(-2)	1.3(-1)	2.4	<6.7(-4)
Bologna	<9.4	<2.0(2)	<9.4(-1)	<16	9.4(3)	9.9(-2)	2.3(-1)	1.5	<9.4(-3)
Bread (White)	<1.9(-1)	2.9(2)	3.8	<1.9	4.8(3)	1.7(-1)	1.6(-1)	8.7(-1)	<1.9(-3)
Bread (Whole Wheat/Rye)	2.6(-2)	4.8(2)	11	3.9(-1)	5.9(3)	3.4(-1)	1.2(-1)	1.9	2.1(-3)
Cantaloupe	<6.6(-2)	1.2(2)	3.2(-1)	<6.6(-1)	2.6(2)	NA	NA	2.2	3.3(-4)
Chicken	<2.4(-2)	2.6(2)	1.2(-1)	<4.1(-1)	5.1(2)	3.2(-2)	5.1(-2)	4.9	3.2(-3)
Coffee	4.0(-2)	1.7(3)	1.8	<6.0(-1)	26	4.4(-1)	4.0(-1)	33	1.2(-2)
Corn (Canned)	<1.3(-1)	ND	3.6(-1)	<2.6	3.0(3)	7.4(-2)	1.0(-1)	1.0	<1.3(-1)
Corn[c]	1.1(-3)	2.7(2)	1.9	6.4(-2)	3.8	5.7(-2)	5.5(-3)	6.8(-1)	4.5(-4)
Cottage Cheese	<4.2(-1)	<2.8(2)	<4.2(-1)	<7.0	3.9(3)	4.2(-2)	1.3(-2)	5.7(-1)	2.0(-3)
Dates	<1.5(-1)	4.5(2)	4.5	<3.0(-1)	38	NA	NA	2.2	<1.5(-3)
Fruit (Canned Mixed) Mixed)	<4.2(-2)	46	7.0(-1)	<5.6(-1)	2.0(2)	7.0(-2)	1.8(-1)	1.4	<5.6(-4)
Grapes (Green)	ND	76	7.7(-1)	<9.0(-2)	12	4.0(-2)	2.6(-1)	9.5(-1)	<4.5(-3)
Green Beans (Canned)	<5.5(-2)	1.7(2)	1.3	<5.5(-1)	2.6(3)	4.0(-2)	2.7(-2)	6.9(-1)	1.1(-3)
Melon (Honeydew)	<5.3(-2)	88	2.2(-1)	1.1	2.0(2)	NA	NA	9.0(-1)	<2.1(-4)
Melon (Water)	5.0(-3)	79	3.3(-1)	<5.6(-2)	6.7	NA	NA	2.2	<2.0(-4)
Milk (Dry)	<2.4(-1)	9.2(2)	<4.1	<3.2	4.0(3)	NA	NA	25	1.6(-1)

Foodstuff	µg/g (wet wt.)										
	Sc	Se	Sr	Ta	Te	Th	Ti	U	V	Zn	Zr
Applesauce	1.5(-5)	2.6(-2)	6.0(-1)	<1.5(-4)	ND[a]	<6.0(-4)	<3.0	4.5(-4)	<1.5(-2)	2.1(-1)	<1.4(-1)
Beans (Baked)	4.6(-4)	<3.0(-2)	<4.0	<2.0(-3)	ND	<4.0(-3)	<16	2.4(-3)	<2.0(-1)	5.0	<9.0(-1)
Beans[c] (Green)	1.1(-3)	9.7(-3)	2.4	<3.4(-4)	<4.1(-4)	2.2(-3)	<2.6	<1.5(-2)	<1.2(-2)	6.5	ND
Beans (Pinto)	<7.2(-4)	1.3(-1)	ND	<3.6(-3)	ND	<3.6(-2)	<7.2	<3.6(-4)	<3.6(-2)	27	ND
Beef (Ground)	<4.8(-4)	<2.9(-2)	<1.9	<4.8(-4)	<2.9(-1)	<4.8(-3)	<1.9	7.6(-4)	<1.9(-2)	29	<9.5(-1)
Bologna	<9.4(-4)	<5.9(-2)	<9.4	<1.6(-3)	ND	<9.4(-3)	<31	9.7(-3)	<3.1(-1)	12	<1.6
Bread (White)	3.0(-4)	7.0(-2)	ND	3.8(-4)	ND	<1.9(-3)	<19	9.7(-4)	<2.9(-1)	6.3	<9.5(-1)
Bread (Whole Wheat/Rye)	6.5(-4)	1.1(-1)	ND	<5.2(-4)	ND	<2.6(-3)	<52	5.5(-4)	5.2(-1)	<12	ND
Cantaloupe	<6.6(-5)	<6.6(-3)	1.2	<3.3(-4)	9.9(-2)	6.6(-4)	<2.0	3.3(-4)	<1.3(-2)	1.1	<3.3(-1)
Chicken	2.4(-4)	<5.7(-2)	ND	<8.1(-4)	ND	<1.6(-2)	<1.6	1.2(-4)	<1.6(-2)	4.2	<1.6
Coffee	3.5(-2)	2.0(-1)	2.7	1.8(-3)	<8.0(-1)	4.0(-2)	5.1	9.2(-3)	6.4(-1)	4.6	<4.0
Corn (Canned)	<1.3(-4)	<1.3(-2)	ND	<2.6(-4)	ND	<1.3(-3)	<26	<1.3(-4)	2.3(-1)	2.9	ND
Corn[c]	1.2(-4)	4.5(-3)	5.0	1.5(-4)	2.2(-4)	6.7(-4)	1.3	5.2(-3)	6.7(-3)	5.2	ND
Cottage Cheese	4.2(-5)	<9.8(-3)	<2.8	<1.4(-4)	ND	<1.4(-3)	<14	1.1(-3)	<1.4(-1)	2.8	<2.1(-1)
Dates	1.3(-3)	1.2(-2)	3.8	<3.0(-4)	ND	<3.0(-3)	<12	3.0(-4)	<1.5(-1)	2.9	<6.0(-1)
Fruit (Canned Mixed) Mixed)	4.5(-5)	1.3(-2)	<1.4	<2.8(-4)	ND	<5.6(-4)	<2.2	1.0(-3)	1.4(-2)	4.8(-1)	<1.7(-1)
Grapes (Green)	1.3(-4)	<4.5(-3)	4.1(-1)	<1.8(-4)	<1.4(-1)	<4.5(-4)	<4.5(-1)	<3.2(-4)	<4.5(-3)	3.9(-1)	<1.4(-1)
Green Beans (Canned)	1.8(-4)	<2.2(-3)	ND	<1.1(-4)	ND	2.2(-4)	<17	1.4(-4)	<2.2(-1)	7.8(-1)	<2.2(-1)
Melon (Honeydew)	9.0(-5)	<5.3(-3)	4.4(-1)	<5.3(-5)	<8.0(-2)	<5.3(-4)	<1.1	2.7(-4)	<1.1(-2)	1.3	<1.6(-1)
Melon (Water)	<5.6(-5)	<2.8(-3)	<1.4(-1)	<1.4(-4)	<2.8(-2)	<2.8(-4)	<2.8(-1)	2.0(-4)	2.8(-3)	8.0(-1)	<2.5(-1)
Milk (Dry)	<1.6(-3)	<1.6(-1)	ND	<4.1(-3)	ND	<4.1(-2)	<41	4.9(-3)	<3.2(-1)	32	–

[a]Nondetectable.
[b]Not Analyzed.
[c]Samples grown in the vicinity of Oak Ridge National Laboratory.

Table 5. Stable element composition in selected foods

Foodstuff	Ash wt./Wet wt.	μg/g (wet wt.) Ag	Al	As	Au	Ba	Br	Ca	Ce	Cd	Cl	Co	Cr	Cs	Cu	Eu	Fe	Hf	Hg	I	K
Oatmeal	1.9(-2)	<3.7(-2)	6.4	<9.5(-3)	<1.9(-2)	1.6	7.6(-3)	5.1(2)	<9.5(-2)	1.4(-2)	<3.7	9.3(-3)	<9.1(-1)	<5.6(-3)	5.5	<7.6(-4)	42	<9.5(-3)	1.6(-4)	<3.8(-1)	3.6(3)
Onions (White & Yellow)	3.4(-3)	3.4(-3)	4.5(-1)	<3.4(-2)	<6.8(-4)	ND[a]	2.1(-1)	1.9(2)	<6.8(-3)	NA[b]	1.7(2)	2.2(-3)	2.4(-2)	<3.4(-4)	6.9(-1)	<1.7(-4)	1.1	<6.8(-4)	3.3(-4)	<3.4(-2)	9.6(2)
Oysters	1.6(-2)	2.4(-1)	32	<8.0(-1)	4.8(-3)	<1.6	17	4.0(2)	<6.4(-2)	4.5(-1)	3.8(3)	1.9(-2)	6.6(-2)	<8.0(-3)	<16	<1.4(-3)	26	<6.4(-3)	22.0(-3)	<8.0(-1)	9.6(2)
Peaches (Fresh)	3.9(-3)	1.2(-3)	7.8(-1)	<3.9(-3)	2.3(-5)	7.0(-2)	2.4(-2)	31	1.3(-2)	NA	15	6.2(-3)	1.2(-2)	1.9(-3)	3.8(-1)	1.3(-4)	1.7	9.4(-5)	1.6(-3)	<7.8(-3)	1.2(3)
Peaches (Canned)	2.5(-3)	<5.0(-3)	1.7	<1.5(-2)	<1.3(-4)	<2.5(-1)	9.8(-2)	22	<7.5(-3)	1.7(-3)	89	3.0(-3)	3.8(-2)	1.5(-3)	<5.0(-1)	<2.5(-4)	1.8	1.1(-3)	1.4(-4)	<2.5(-2)	9.1(2)
Peanut Butter	3.2(-2)	<3.2(-2)	12	<6.4(-1)	<3.2(-3)	1.3	11	2.7(3)	3.2(-2)	4.2(-2)	6.0(3)	5.1(-2)	1.2(-1)	<2.2(-2)	<26		17	1.6(-3)	4.5(-4)	<1.6	5.9(3)
Peas (Sweet & Canned)	1.1(-2)	1.1(-2)	3.0	<3.3(-1)	<2.2(-3)	<5.5(-1)	6.5(-1)	1.6(2)	<2.2(-2)	2.0(-3)	4.3(3)	3.6(-3)	4.0(-2)	<2.2(-3)	<6.6	<4.4(-4)	8.6	<2.2(-3)	2.8(-4)	<5.5(-1)	6.4(2)
Pineapple (Canned)	3.0(-3)	3.0(-3)	3.6(-1)	<3.0(-2)	<3.0(-4)	<1.5(-1)	1.9	87	<6.0(-3)	4.8(-3)	2.2(2)	3.9(-3)	9.6(-2)	4.2(-3)	<9.0(-1)	1.2(-4)	1.7	<6.0(-4)	1.0(-5)	<1.2(-1)	1.1(3)
Pork	1.2(-2)	1.2(-2)	3.5	<3.6(-1)	<1.2(-2)	<4.8(-1)	8.2(-1)	43	<2.4(-2)	6.6(-2)	4.9(2)	ND	3.2(-2)	1.8(-2)	<1.8	1.2(-4)	11	<1.2(-2)	3.9(-4)	<8.4(-2)	3.4(3)
Potatoes[c]	1.8(-2)	2.1(-2)	4.5(1)	1.3(-2)	1.7(-4)	1.0	3.7	6.2(1)	1.3(-1)	<2.9(-2)	2.8(2)	6.3(-2)	3.8(-1)	6.1(-3)	<1.2	1.3(-3)	6.2(1)	1.7(-2)	ND	2.0	2.7(3)
Potato Chips	3.6(-2)	<1.8(-2)	<3.2	<7.2(-1)	<7.2(-3)	<7.2(1)	1.2	2.4(2)	<7.2(-2)	6.1(-2)	8.8(3)	3.2(-2)	1.1(-1)	<7.2(-3)	<29	<3.6(-4)	12	<3.6(-4)	<5.8(-3)	<2.2	8.8(3)
Prunes	1.9(-2)	1.9(-2)	6.8	<1.5(-1)	<9.5(-4)	7.2(-1)	7.6	5.3(2)	<3.8(-2)	NA	1.3(2)	2.1(-2)	8.2(-2)	9.7(-3)	2.5	<1.9(-4)	15	<1.9(-3)	1.1(-3)	<1.5(-1)	7.2(3)
Rice	5.0(-3)	1.0(-2)	2.6	7.9(-2)	<7.5(-5)	<5.0(-1)	3.0(-3)	1.2(2)	<2.5(-2)	1.2(-2)	<1.0	1.5(-2)	5.1(-2)	<5.0(-3)	1.7	ND	33	<2.5(-3)	3.3(-3)	<1.1(-1)	8.2(2)
Salmon	2.2(-2)	2.3(-2)	5.0	<5.8(-1)	<4.6(-3)	<2.3	4.3	2.3(3)	<1.2(-1)	7.1(-3)	3.7(3)	3.5(-3)	<1.2(-2)	1.2(-2)	<14	6.9(-4)	4.1	<4.6(-3)	7.1(-3)	ND	2.6(3)
Sardines	2.8(-2)	<2.8(-2)	6.4	<8.4(-1)	<5.6(-3)	<2.5	6.6	2.2(3)	<1.1(-1)	2.3(-2)	6.9(3)	5.6(-3)	<2.0(-1)	1.1(-2)	<17	5.6(-4)	14	<5.6(-3)	10.2(-3)	<8.4(-1)	2.3(3)
Shrimp	2.5(-2)	ND	23	<2.5(-1)	ND	<1.3	1.1	3.7(2)	<1.0(-1)	NA	5.9(3)	8.8(-3)	2.9(-1)	5.0(-3)	<25	<7.5(-4)	23	<5.0(-3)	1.5(-3)	<1.2	1.1(3)
Spaghetti	7.2(-3)	<1.4(-2)	5.3	3.6(-3)	1.0(-1)	1.7	1.4(-2)	1.7(2)	<4.3(-2)	6.8(-2)	<7.2(-1)	3.1(-3)	2.5(-2)	2.1	2.1	<2.2(-4)	32	<3.6(-3)	2.6(-4)	<7.2(-2)	1.6(3)
Spinach	1.9(-2)	<1.9(-2)	22	<3.8(-1)	<3.8(-3)	1.7	1.2	1.2(3)	3.6(-2)	1.6(-1)	3.5(3)	1.7(-2)	6.7(-2)	<3.8(-3)	<9.5	7.2(-4)	17	<4.4(-3)	1.4(-5)	ND	3.5(3)
Tea	1.3(-1)	<1.3(-1)	7.6(2)	<2.7(-1)	<6.5(-3)	6.0	8.4	<1.3(3)	<2.7(-1)	2.3(-2)	1.8(3)	3.1(-1)	5.8(-1)	7.4(-1)	<67	ND	1.5(2)	<2.7(-2)	2.0(-3)	<6.7	5.6(4)
Tomatoes (Canned)	7.5(-3)	1.1(-2)	<3.0	<3.8(-1)	<7.5(-3)	<3.8(-1)	1.2	2.5(2)	7.5(-3)	2.3(-2)	2.4(3)	4.1(-3)	6.7(-2)	2.3(-3)	<7.5	<7.5(-5)	5.6	<7.5(-4)	4.5(-7)	<3.8(-1)	1.4(3)
Tomatoes[c]	8.4(-3)	5.9(-2)	1.5	9.2(-3)	1.7(-4)	<1.3(-1)	4.4(-1)	5.4(1)	<4.2(-3)	9.4(-3)	2.3(2)	1.3(-2)	1.3(-1)	3.9(-4)	6.5(-1)	<2.0(-4)	5.3	5.1(-4)	ND	2.4(-1)	2.7(3)
Tuna Fish	2.0(-2)	<1.0(-2)	4.0	<6.0(-1)	<8.0(-3)	<6.0(-1)	3.2	<1.0(2)	<4.0(-2)	3.8(-2)	5.0(3)	7.2(-1)	5.0(-2)	3.0(-2)	<16		8.9	<2.0(-3)	3.8(-2)	<1.0	3.0(3)
Weiners	3.3(-2)	<3.3(-2)	<33	<6.6(-1)	<9.9(-3)	<1.7	2.4	<3.3(2)	<6.6(-2)	5.3(-3)	1.4(4)	5.0(-3)	8.3(-2)	<6.6(-3)	<33	<9.9(-4)	11	<6.7(-3)	5.3(-4)	<1.7	1.4(3)

[a]Nondetectable

[b]Not Analyzed.

[c]Samples grown in the vicinity of Oak Ridge National Laboratory.

Table 6. Stable element composition in selected foods

Foodstuff	$\mu g/g$ (wet wt.)																			
	La	Mg	Mn	Mo	Na	Ni	Pb	Rb	Sb	Sc	Se	Sr	Ta	Te	Th	Ti	U	V	Zn	Zr
Oatmeal	<5.7(-3)	1.5(3)	36	9.3(-1)	20	3.3	2.3(-1)	5.7	<1.9(-3)	<1.9(-3)	<7.6(-2)	ND	<1.9(-3)	ND	<1.9(-2)	ND	<1.9(-4)	<3.8(-2)	32	ND
Onions (White & Yellow)	<1.7(-2)	81	6.0(-1)	ND[a]	61	NA[b]	NA	1.5(-1)	3.4(-4)	2.7(-5)	<6.8(-3)	2.6	<1.7(-4)	<2.0(-1)	<1.0(-3)	<6.8(-1)	3.1(-4)	<6.8(-3)	1.1	<1.7(-1)
Oysters	<1.6(-1)	5.8(2)	5.5	<2.4	3.7(3)	1.0(-1)	3.2(-1)	2.9(-1)	<3.2(-3)	6.7(-3)	<8.0(-2)	ND	<1.6(-3)	ND	<8.0(-3)	<16	1.6(-2)	4.5(-1)	88	3.2
Peaches (Fresh)	7.0(-3)	54	4.1(-1)	<3.9(-2)	3.1	NA	NA	1.9	7.8(-4)	7.8(-5)	<7.8(-4)	<7.8(-2)	<3.9(-5)	<4.3(-2)	<3.9(-4)	<3.9(-1)	3.9(-5)	<3.9(-3)	7.2(-1)	<5.9(-2)
Peaches (Canned)	<5.0(-3)	37	1.9(-1)	<5.0(-2)	73	4.5(-2)	9.0(-2)	7.3(-1)	<1.3(-3)	5.5(-5)	<7.5(-3)	ND	<2.5(-4)	ND	<1.3(-3)	<7.5(-1)	9.0(-4)	1.1(-2)	5.0(-1)	<2.5(-1)
Peanut Butter	<3.2(-1)	1.4(3)	17	<4.8	3.8(3)	7.4(-1)	3.8(-1)	9.6	<1.6(-1)	1.2(-3)	<3.2(-2)	ND	6.4(-4)	ND	<1.6(-3)	<64	<3.2(-4)	4.8(-1)	18	ND
Peas (Sweet & Canned)	<1.1(-1)	1.7(2)	1.6	<1.1	2.9(3)	2.2(-1)	3.3(-1)	4.7(-1)	<1.1(-3)	1.7(-4)	<1.8(-2)	ND	<5.5(-4)	ND	<5.5(-3)	11	3.2(-4)	1.1(-1)	3.5	<1.1
Pineapple (Canned)	<3.0(-3)	1.1(2)	11	<4.5(-2)	3.3	3.0(-1)	1.2(-1)	1.1	<3.0(-4)	2.4(-5)	8.7(-3)	ND	<3.0(-4)	ND	<1.5(-3)	<3.0	5.1(-5)	<3.0(-2)	4.8(-1)	<3.0(-1)
Pork	<1.8(-1)	2.1(2)	<3.6(-1)	<3.6	5.4(2)	3.0(-2)	1.6(-1)	4.4	<7.2(-4)	<2.4(-4)	<1.2(-2)	<1.2	<2.4(-4)	<7.2(-2)	<1.2(-3)	<2.4	6.0(-4)	<2.4(-2)	28	<6.0(-1)
Potatoes[c]	2.65(-2)	1.4(2)	1.6	4.9(-2)	8.7	<5.0(-1)	<1.1(-1)	8.8(-1)	1.8(-3)	1.5(-2)	<1.1(-2)	3.4	1.5(-3)	8.9(-4)	1.8(-2)	3.5	<8.4(-3)	7.9(-2)	5.3	ND
Potato Chips	<1.8(-1)	4.9(2)	2.9	<1.0	5.2(3)	2.9(-1)	1.8(-1)	2.3	<7.2(-3)	1.8(-4)	2.9(-1)	<1.4(2)	<1.8(-3)	ND	<3.6(-3)	<36	<5.8(-3)	<3.6(-1)	3.8	ND
Prunes	<1.9(-2)	4.4(2)	2.7	<9.5(-1)	29	NA	NA	6.6	3.8(-2)	7.4(-2)	4.2(-2)	4.8	<9.5(-4)	ND	<1.9(-3)	<3.8	2.9(-3)	<1.9(-2)	4.2	<7.6(-1)
Rice	4.3(-3)	3.8(2)	13	1.3	4.7	8.5(-2)	3.5(-2)	1.8	<5.0(-3)	4.0(-4)	3.0(-2)	ND	<1.0(-4)	ND	<2.5(-3)	<2.5	3.2(-4)	5.1(-2)	13	ND
Salmon	<1.2(-1)	2.2(2)	1.7	<2.3	3.3(3)	7.8(-2)	2.0(-1)	8.3(-1)	<2.3(-2)	<4.6(-4)	<9.2(-2)	ND	<1.2(-3)	ND	<1.2(-2)	<21	4.6(-4)	<2.3(-1)	4.6	<2.3
Sardines	<1.4(-1)	4.2(2)	<4.2	<2.8	5.1(3)	9.7(-2)	4.7(-2)	7.3(-1)	2.8(-3)	6.2(-4)	<1.1(-1)		<1.4(-3)	ND	<1.4(-2)	<28	3.1(-3)	<2.8(-1)	27	<2.8
Shrimp	<5.0(-2)	5.0(2)	<2.0	<5.0(-1)	7.8(3)	NA	NA	<2.0(-1)	3.8(-2)	4.3(-3)	<5.0(-2)	ND	2.5(-3)	ND	<7.5(-3)	<50	1.6(-3)	<5.0(-1)	4.1	ND
Spaghetti	1.7(-3)	4.6(2)	6.3	3.2(-1)	8.6	5.6(-2)	9.4(-2)	1.2	<1.4(-3)	<1.9(-3)	<3.6(-2)	ND	<7.2(-4)	ND	<3.6(-3)	ND	1.1(-4)	5.4(-3)	11	ND
Spinach	<9.5(-2)	8.2(2)	7.0	<1.5	2.3(3)	2.5(-1)	8.9(-1)	7.4(-1)	<1.9(-3)	3.2(-3)	<3.8(-2)	ND	<1.9(-3)	ND	5.7(-3)	<19	1.7(-3)	<1.9(-1)	3.0	<1.9
Tea	<1.3(-1)	3.1(3)	<7.0(2)	<2.0	8.9(2)	4.2	1.0	1.4(2)	ND	3.6(-3)	2.6(-1)	ND	<6.5(-3)	ND	<6.5(-2)	ND	3.6(-3)	<6.5(-1)	18	ND
Tomatoes (Canned)	<1.5(-1)	86	7.5(-1)	<3.8	1.1(3)	1.4(-1)	2.6(-1)	1.7	5.3(-4)	9.0(-5)	1.1(-2)	2.9	6.0(-4)	ND	<1.5(-3)	<7.5	2.3(-4)	<7.5(-2)	1.7	<3.0(-1)
Tomatoes[c]	<9.2(-4)	1.0(2)	9.4(-1)	<2.6(-2)	1.1(1)	2.8(-2)	3.8(-2)	6.5(-1)	<3.9(-4)	1.8(-4)	3.4(-3)	8.7(-1)	1.7(-4)	<2.0(-4)	1.8(-2)	3.5	<2.0(-3)	7.8(-2)	5.26	ND
Tuna Fish	<2.0(-1)	3.3(2)	<2.0	<4.0	4.0(3)	4.6(-2)	1.3	6.0(-1)	<2.0(-1)	<2.0(-4)	<4.0(-2)	ND	<4.0(-4)	ND	<1.0(-2)	<20	9.4(-4)	<2.0(-1)	3.6	ND
Weiners	<3.3(-1)	<6.6(2)	<6.6	<5.0	9.2(3)	6.6(-2)	5.0(-1)	2.7	<6.6(-3)	<6.6(-4)	<6.6(-2)	ND	<1.7(-3)	ND	<1.7(-2)	ND	<3.3(-4)	<6.6(-1)	17	ND

[a]Nondetectable.
[b]Not Analyzed.
[c]Samples grown in the vicinity of Oak Ridge National Laboratory.

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