Mineral composition of cereals and legumes indigenous to Haiti

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SUMMARY

Eighty-six samples representing all of the staple food crops indegenous to Haiti were analyzed for calcium, magnesium, zinc, manganese, iron, molybdenum, and copper. Sampling replicated varieties and localities of production well enough in most instances to give figures reliable for dietary calculation. Differences between these values and U.S.D.A. Handbook values were quite large in some cases for calcium, iron, and phosphorus.

In an earlier publication, King (4) described the protein and amino acid content of the cereals and legumes indigenous to Haitian markets. From those data mixtures of those foods have been developed by evaluation in the rat (9) and in preschool age children (5) which provide sufficient protein of good enough quality that they can be used as an economical basis for the successful feeding of very young children.

Although specific mineral deficiencies have not been reported among either humans or livestock in Haiti, the data of Sebrell and his colleagues (8) would suggest that marginal to clinical deficiencies may occur. Anemias are common (6, 8), but the extent to which they relate to iron and copper nutriture in contrast to folic acid or vitamin B_{12} intake or to parasitism is not clear. From the dietetic standpoint the absence or reliable analytical data on calcium, phosphorus, and iron content of local foods leaves considerable doubt about the

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reliability of mineral nutrient intakes obtained by means of dietary surveys (2).

The present report indicates the mineral composition of a comprehensive collection of cereals and legumes commonly used in peasant diets. Data on calcium, phosphorus, magnesium, copper, zinc, iron, manganese, molybdenum, and cobalt are included.

SAMPLING AND ANALYTICAL PROCEDURES

The samples used were the same as those the collection of which has already been described (4). They had been stored at —5° to —10° C. for three years prior to the mineral analyses.

Analyses for calcium, magnesium, copper, zinc, manganese and iron were conducted on wet-ashed samples using the Perkin-Elmer Atomic Absorption Spectrophotometer Model 303. Molybdenum analyses were performed as described by Evans *et al.* (3). Cobalt and phosphorus analyses followed the official A.O.A.C. procedures (1).

Figure 1.—Locations in the Republic of Haiti from which samples were secured. Sample locations are indicated as 1, Cap Haitien; 2, Port de Paix; 3, Gonaives; 4, Los Cahobas; 5, Verettes; 6, St. Marc; 7, Mireabalais; 8, Poste Terre Rouge; 9, Port-au-Prince; 10, Kenscoff; 11, Furcy; 12, Forêt des Pins; 13, Jacmel; 14, Miragoane; 15, Les Cayes and 16, Jeremie.

RESULTS AND DISCUSSION

The origin of the samples is shown in Figure 1. All of the major food-producing and population centers of the country have been covered. In most instances multiple samples were obtained from the various locations as seen in Table 1 which summarizes the sampling locations for each of the crops. In general, multiple samples were obtained from areas where a given crop is traditionally grown in large amounts.

Table 2 summarizes the analytical data in terms of average values and the standard deviations. For reference purposes the corresponding figures of Watt and Merrill (10) are also given for calcium, phosphorus, iron, and magnesium in several of the crops.

Analysis of the data on individual samples from the various localities showed no consistent correlation between composition of the crops and the region where they were grown indicating that there is no reason in using these data for calculating dietary intake to distinguish one locality from another. It also indicates that regardless of the variations in soil type, other factors such as climate, tillage practices, climatic differences ,and varietal variations are over-riding soil factors in determining mineral composition of these crops.

The corn and peanut samples embrace both varieties maturing in 3 months and varieties maturing in 5 months, there being no apparent differences in the mineral composition of the two varieties. The rice samples all of which had been milled include the brown-colored mountain rices, indigenous low land white varieties, and highly inbred varieties such as Fortuna, Buffalo, Blue Bonnet, and Rex Oro. Here too variety had no major effect on mineral composition.

Important differences exist between these values and those of the widely used food composition tables prepared by Watt and Merrill (10) and the INCAP-ICNND tables (7). Referring to Table 2, for example, it is seen that Haitian corn and rice provide only about half as much calcium as the handbooks would suggest. On the other hand, Haitian sorghum has nearly 3 times the iron indicated by the handbooks; Haitian rice is almost 7 times as high in iron; and Haitian cowpeas are only about half as high in iron. Discrepancies in phosphorus

TABLE 1

SOURCE OF FOOD SAMPLES BY LOCATION

Food	NUMBER OF SAMPLES OBTAINED FROM								Total
	Cap Haitien	Port-de-Paix	Las Cahobas	Gonaives	Port-au-Prince	Jacmel	Les Cayes	Jeremie	
pois blanc*	1	1	1	1	2	1	0	0	7
pois rouge	2	2	2	1	2	1	1	1	12
pois noir	1	0	2	1	1	2	1	0	8
pois buerre	2	0	1	0	2	0	0	0	5
pois jeune	0	0	0	0	0	1	0	0	1
pois valet	0	0	0	0	1	0	0	0	1
pois souche	0	0	1	0	0	1	0	1	3
pois nourrice	0	0	0	0	1	0	0	1	2
pois inconnu	0	0	0	0	0	2	0	0	2
pois congo	0	1	1	1	1	1	1	1	7
pistache	1	1	0	0	0	0	1	2	5
riz	3	1	1	5	0	1	1	0	12
maiz	2	0	1	1	2	3	1	1	11
petit mil	0	1	1	3	2	1	2	0	10
total	12	7	11	13	14	14	8	7	86

* Scientific names are given in Table 2.

TABLE 2

MINERAL COMPOSITION OF HAITIAN AND AMERICAN CEREALS AND LEGUMES

(All values are ppm on dry basis)*

	Haitian Name	Calcium	Magnesium	Copper	Zinc	Manganese	Iron	Molybdenum	Cobalt	Phosphorus
Phaseolus vulgaris	pois blanc	2,221±362	1,980±105	16.4±1.0	33.8± 3.4	20.5± .96	98.4±19.2	5.88±2.2	0.26±0.09	3,950
" "	" rouge	1,753±225	1,778±148	15.3±1.5	33.9± 6.1	19.2±3.4	84.3±23.4	4.97±3.1	0.20±0.14	4,525±717
" "	" beurre	1,655±196	1,735± 29.9	16.0±1.2	33.6± 4.9	16.6±4.3	85.4± 9.6	3.45±1.6	0.20±0.23	4,583±325
" "	" noir	1,796±171	1,800± 97.6	15.9±1.2	36.6± 3.2	18.1±2.0	89.2±18.6	4.14±2.6	0.20±0.12	4,800±511
" "	" jaune	1.500	1,562	15.2	28.2	16.2	123	4.11	0.05	—
" "	" valet	2,025	2,012	15.6	25.0	18.6	101	3.75	0.21	—
" *lunatus*	" souche	733±118	1,587± 66.1	9.7±1.2	31.7± 1.6	20.8±1.4	90.3±23.2	3.41±0.3	0.04±0.00	—
Dolichos lablab	" nourrice	692± 24.7	1,806±150	15.4±0.3	28.0± 0.6	27.1±1.0	81.5±27.6	5.84±3.9	0.04±0.01	3,500
Vigna sinensis	" inconnu	1,532±753	2,319±203	13.0±0.9	31.4± 0.3	18.6±0.9	106.5±13.4	2.76±0.9	0.07±0.01	—
Cajanus indicus	" congo	950±132	1,328± 72.1	18.5±0.9	30.8± 6.8	11.6±2.2	54.8±12.8	4.52±3.0	0.02±0.00	3,335±264
Arachis hypogea	pistache	543± 24.9	2,057±162	17.6±0.9	46.2± 9.2	20.1±3.1	64.4±13.0	1.96±1.6	0.04±0.03	4,250
Oryza sativa	riz	153± 73.2	485±318	6.6±2.7	18.0± 3.1	12.6±6.3	63.2±25.1	0.56±0.2	0.05±0.04	1,767±407
Zea maiz	mais	117± 18.1	1,151± 63.9	4.6±0.8	30.5± 1.9	5.2±1.1	40.4±14.8	0.74±0.3	0.03±0.01	2,879±259
Sorghum vulgare	petit mil	3,110±221	639±164	4.6±2.0	15.8±10.2	8.3±3.2	139 ±18.4	0.77±0.4	0.06±0.09	1,438±382
P. vulgaris	White (blanc)**	1,620	1,910				87			4,760
" "	Red (rouge)**	1,230	1,820				77			4,540
" "	Lima (beurre)**	803	2,080				87			5,400
Zea maiz	Corn (mais)**	228	1,210				66			3,030
Sorghum vulgare	Sorghum (petit mil)**	225	—				50			3,230
Oryza sativa	Rice (riz)**	273	319				9			1,090
Vigna sinensis	Cowpeas (pois inconnu)**	828	2,590				65			4,760

* All values are mean ± standard deviation. Where no standard deviation is shown, only a single value was available. Dashes indicate no analysis was run because the sample was exhausted.

** After Watt and Merrill (10).

values approaching two-fold are also seen for sorghum and rice. These cereals being mainstays in the Haitian diet, the errors introduced into dietary surveys are large if nutrient intakes are calculated from available food composition tables.

It is quite apparent that if reliable estimates of mineral intake are to be secured in the emerging nations, the values in handbooks based on analysis of samples from the United States cannot be relied on. New values will have to be obtained from each country or at least each region of the world.

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RESUMEN

Se presentan los resultados de análisis de calcio, magnesio, cobre, zinc, manganeso, hierro, molibdeno y cobre efectuados en 86 alimentos representativos de Haití. Se estima que se han incluido un número suficiente de muestras de las distintas zonas y alimentos para que los resultados puedan servir de base para los cálculos dietéticos. Se han observado, en algunos casos, diferencias con valores del U.S.D.A. Handbook en calcio, hierro y fósforo.

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