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Technical Note

Mineral Contents of Agricultural Products

ABSTRACT

Mineral contents of agricultural products (maize, sorghum, cowpea, soybean, cassava, sweet potato, water yam and white yam) grown in Ilorin, Kwara State, Nigeria, were determined by the use of atomic absorption spectrophotometric and colorimetric methods. The grains (maize, sorghum, cowpea and soybean) had low moisture levels (7·8–15·3%) while the tubers (cassava, sweet potato, water yam and white yam) had high moisture levels (56·8–81·2%).

The ash content of the samples varied between 0·6–6·2%. Magnesium and potassium contents varied between 377–4510 mg/100 g food sample. All other minerals (iron, calcium, zinc, manganese) were present in low amounts compared with potassium and magnesium. Mercury and lead contents were found to be below 0·1 mg/100 g food sample.

Cowpea was found to have the highest level of mineral nutrients of the grain samples, while sweet potato was found to have the highest level of mineral nutrients of the tuber samples.

INTRODUCTION

An adequate knowledge of the chemical composition of food is vital to the health, well-being and safety of the consumer. Even nowadays, deficiencies of calcium and iron in foods can lead to abnormal bone development and anemia, respectively (Roberts, 1981).

The present study therefore reports the mineral contents of some grains and tubers produced in Ilorin, Kwara State, Nigeria. There is no reported work on the mineral contents of agricultural products produced in Ilorin.

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However, Oyenuga (1968) and Eka (1986) have reported mineral contents of some agricultural products produced in other parts of the country. Their data were restricted to very few minerals (calcium, iron and phosphorus). Olaofe *et al.* (1987) have also shown that mineral contents of agricultural products (cocoa bean) varied with location. It is hoped that the results of the present study will help in generating data for the much needed food composition table in Nigeria, and will also provide food manufacturers with knowledge of the levels of minerals in their basic raw materials.

MATERIALS AND METHODS

The agricultural products (maize, sorghum, cowpea, soybean, white yam, sweet potato, cassava and water yam) were purchased from a farm very close to the Nigerian Airport in Ilorin, Kwara State, Nigeria. Each sample (about 2 kg), was blended using a Kenwood food mixer. The moisture and ash contents were then determined using the air oven and dry ashing methods of Pearson (1976).

The ash was digested with 3M hydrochloric acid and mineral contents were determined by atomic absorption spectrophotometry; mercury and lead contents were determined colorimetrically according to Vogel (1962).

RESULTS AND DISCUSSION

Table 1 presents the results of this study. Moisture and ash contents are recorded in percentages while metal contents are in mg/100 g food sample. The values reported are averages of two or more determinations.

The ash content, which ranged between 0·6% and 6·5%, is an indication of the total quantity of inorganic compounds in the samples. Higher values were obtained for the grains while the tubers have lower values, except sweet potato. The high ash values obtained for grains could be due to the fact that their brans were not removed. The present results for the grains are in fair agreement with those of Oyenuga (1968), (maize, 3·68%; soybean, 5·06%; sorghum, 2·6% and cowpea, 3·78%) and the results for tubers agreed with those of Eka (1986), (yam species, 0·6–1·7%; cassava, 0·90%; cocoyam, 1·2%; potato, 1·6%). Slight differences are probable because the composition of the soils affects the mineral content of the agricultural products. Olaofe *et al.* (1987) have shown that mineral contents of agricultural products (cocoa beans) varied with location. Potassium was the predominant mineral present in all food samples. Cowpea had the highest amount (4510 mg/100 g) while cassava had the lowest (83 mg/100 g). The differences in values of potassium

TABLE 1
Metal Contents of Agricultural Products

	Soyabean	*Cowpea*	*Maize*	*Sorghum*	*Cassava*	*White yam*	*Water yam*	*Sweet potato*
Moisture (%)	13·0	7·8	10·2	15·3	62·3	71·0	81·2	56·8
Ash (%)	5·90	6·2	1·9	1·9	0·9	0·6	1·2	6·5
Calcium (mg/100 g)	134	125	2·2	8·3	15·5	10·1	25	112
Magnesium (mg/100 g)	334·6	1 195	377	747	83	48	248	580
Potassium (mg/100 g)	1 202	4 510	757	644	377	1 189	2 256	3 617
Sodium (mg/100 g)	2·7	13·8	3·5	23	1·2	38	60	12·2
Manganese (mg/100 g)	3·9	10·9	2·1	4·7	0·8	6·2	9·5	8·8
Iron (mg/100 g)	11·5	20·1	5·3	12·7	1·5	12·4	16·5	14
Copper (mg/100 g)	1·1	2·2	0·8	1·2	0·2	1·4	1·9	1·5
Zinc (mg/100 g)	0·8	21·7	3·8	6·2	0·7	2·3	0·4	3
Lead (mg/100 g)	ND	0·05	0·02	0·02	0·07	ND	ND	ND
Mercury (mg/100 g)	ND	ND	ND	ND	ND	ND	ND	ND

ND = Not detectable.

in all the foods are probably due to different rates of adsorption of minerals by the plants. Values obtained for tubers are higher than those reported by Smith (1983), (cassava, 399 mg; yam, 393 mg; sweet potato 299 mg/100 g food sample) and Eka (1986), (yam species, 294–397 mg/100 g food sample). Differences observed could result from variation in chemical composition of soils.

Magnesium is the next highest mineral in the food samples. Cowpea (1195 mg/100 g) has the highest value while white yam (47·8 mg/100 g) has the lowest. Calcium and iron contents for all the food samples are low; however, the calcium content was found to be higher than that of iron. The iron content varied between 20 mg/100 g for cowpea and 1·5 mg/100 g food sample for cassava. The present results are higher than those reported by FAO (1986), Eka (1986) and Watson (1971) (white yam, 0·6 mg; cassava, 1·9 mg; water yam, 1·1 mg; sweet potato, 1·1 mg/100 g). Values obtained for the grains varied slightly from those reported by Oyenuga (1968) (soybean, 7 mg; maize, 2·5 mg; sorghum, 0·37 mg and cowpea, 4 mg/100 g sample). However, the present results follow the same trend as those reported by Oyenuga (1968).

All the samples had low levels of manganese (10·8–11·0 mg/100 g), copper (0·2–2·3 mg/100 g), zinc (10·4–21·7 mg/100 g) and sodium (3·5–60 mg/100 g). Lead and mercury were not detected with the analytical method used. This indicated that their concentrations are less than 0·1 mg/100 g food samples, because the method detected 0·1 mg/100 g solution.

The level of minerals differs considerably between the different food samples. In order to quantify the relative differences in levels of minerals, the samples were ranked according to Olaofe & Onajeta (1986). Cowpea emerged as being the richest in mineral content of all the grains, while sweet potato had the highest quality of minerals of all the tubers.

CONCLUSIONS

The grains have low moisture contents (7·8–15·3%) while the tubers have high moisture contents (56·8–81·2%). All the samples have high magnesium and potassium contents. All other minerals (iron, calcium, zinc, copper, manganese) were present in low amounts in all the samples compared with potassium and magnesium. Mercury and lead contents were found to be below 0·1 mg/100 g food sample.

Cowpea was found to contain the highest mineral nutrient levels of the grains while sweet potato had the highest mineral nutrient levels of the tubers investigated.

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