Food Chemistry **22** (1986) 315–320

Technical Note

Chemical Composition of Some Plant Products of the Savanna Forest Zone of Nigeria

INTRODUCTION

Some plant materials are used extensively but little or no published information exists on their chemistry and possible physiological effects. Such materials include Shea butter (Yoruba—*Ori*) from the seeds of *Butyrospernum paradoxum* (Gaernt. F.) which is used as a cooking fat. The seeds are also eaten raw by children. The fruit of *Cucurbita pepo* (Linn.), pumpkin, is also used; the yellow pulp, obtained after peeling the obovoid fruits, is cut into pieces, sun-dried and used as meat substitutes in making *elegede* soup in Yoruba villages. The Hausas make the fresh pulp into a porridge called *miyan taushe*. The fruit of *Luffa aegyptiaca* (Mill), dish cloth gourd, which is also a cucurbit, contains a sponge-like mesocarp and 10–15 black seeds. The filtrate from this boiled and filtered fruit is used as an antidote against snake venom for cattle by the Fulanis. *Tithonia* sp. (Wall. ex. Wight), an annual plant, bears heads with the seeds containing relatively high amounts of vegetable oil. *Mucuna pruriens* var. *utilis* (Wall. ex. Wight) is grown as pasture, hay or as a silage plant. The seeds are used in ruminant feeding. The whole fruits of *Strychnos spinosa* (Lam) are eaten raw by hunters in the forest.

This study was aimed at filling the information gap by determining the chemical composition of some of these materials used in either human or livestock feeding.

MATERIALS AND METHODS

Matured plant materials were collected in all cases. The pulp of *Cucurbita pepo* and the fruit of *Strychnos spinosa* were cut into pieces and oven-dried

Food Chemistry 0308-8146/86/$03·50

at 70°C. The seeds of the other plants were oven-dried and shelled except the seeds of *Tithonia* which were too difficult to shell. All the dried samples were milled in a Waring blender to pass through a 1·66 mm sieve. Milled samples were stored in airtight Kilner jars, labelled and kept in a deep-freezer at −4°C until analysed.

Proximate compositions for all samples were determined according to standard methods of the Association of Official Analytical Chemists (AOAC, 1975). Nitrogen Free Extractives (NFE) were determined by difference. Total soluble carbohydrates were determined by the anthrone method of Johnson *et al.* (1964) while total reducing sugars were determined as described by Nelson (1944) and Somogyi (1945). Gross energy values were determined using the ballistic bomb calorimeter with analytical grade benzoic acid as standard.

The perchloric acid digestion (wet oxidation) method was used for preparing samples for mineral analysis. Mg^{2+}, Ca^{2+}, Na^{+} and K^{+} contents of the sample hydrolysates were determined by flaming in a Perkin Elmer atomic absorption spectrophotometer 290.

Iodine and saponification numbers of lipids extracted from *Butyrospernum paradoxum* and *Tithonia* sp. seeds were determined according to standard methods of the AOAC (1975). The refractive index of the lipids was determined at 28°C using an Abbe refractometer.

RESULTS AND DISCUSSION

The proximate composition of the materials analysed is given in Table 1. Relatively high crude protein contents of 33·9%, 20·5%, 19·7% and 16·8% DM, obtained for seeds of *L. aegyptiaca*, *Tithonia* sp., dehulled seeds of *C. pepo* and shelled cooked seeds of *M. pruriens*, show them to be promising protein sources. These values compare with those reported by Fetuga *ėt al.* (1973; 1974) for cashew nut good kernel ether-extracted, 36·04%; African locust bean seed, 30·02%; cashew nut good kernel undefatted, 21·20%, and palm kernel meal, 18·70%. Reduction of the protein content of pulp meal from *C. pepo* to 7·7% DM is suggestive of a high content of non-protein nitrogen, which was removed by hot water treatment.

B. paradoxum, *C. pepo* and *Tithonia* sp. seeds, with 60·7%, 36·8% and 29·5% DM ether-extracts, respectively, show potentials as sources of vegetable oils. These values fall within the range for conventional sources, such as palm kernel, 54·0%, groundnut seeds, 39·1–47·8%, dehulled soya bean seeds, 20·4%, and cotton seeds, 20·1–26·2% (Gohl, 1981). The physical (refractive index at 28°C) and chemical constants (iodine and saponification numbers) of the oils from *B. paradoxum* and *Tithonia* sp.

TABLE 1
Proximate Composition of Plant Materials

	Butyrospernum paradoxum		Cucurbita pepo			Mucuna pruriens		Tithonia *sp.*	Luffa aegyptiaca	Strychnos spinosa
	Undefatted seed meal	*Defatted seed meal*	*Raw pulp meal*	*Cooked pulp meal*	*Dehulled seed meal*	*Shelled raw seed meal*	*Shelled cooked seed meal*	*Unshelled seed meal*	*Shelled seed meal*	*Whole fruit*
Dry matter (DM) (%)	92·7	91·1	86·2	84·1	87·5	89·8	93·8	85·0	92·3	84·6
Crude protein (% DM)	4·1	20·2	18·8	7·7	19·7	16·0	16·8	20·5	33·9	3·1
Ether extract (% DM)	60·7	36·2	5·0	12·4	36·8	8·4	7·9	29·5	3·0	1·5
Crude fiber (% DM)	7·5	8·5	4·8	5·1	5·7	2·2	2·4	24·1	4·5	13·5
Total ash (% DM)	3·6	3·3	7·3	6·8	2·3	5·8	2·7	4·6	3·2	3·5
Nitrogen-Free extract (% DM)	24·1	31·9	64·1	68·0	35·5	67·6	70·2	20·9	55·4	78·4
Mg^{2+} (% DM)	0·06	—	0·24	—	—	—	—	—	0·14	0·09
Ca^{2+} (% DM)	0·06	—	0·02	—	—	—	—	—	0·20	0·05
K^{+} (% DM)	0·64	—	0·32	0·30	—	0·14	0·13	—	1·34	0·56
Na^{+} (% DM)	0·004	—	0·04	0·004	—	0·03	0·04	—	0·01	0·002

TABLE 2
Carbohydrate Fractions and Lipid Constants of Plant Products

	Butyrospernum paradoxum		Cucurbita pepo		Mucuna pruriens		Tithonia *sp.*	Luffa aegyptiaca	Strychnos spinosa
	Undefatted seed meal	*Defatted seed meal*	*Raw pulp meal*	*Cooked pulp meal*	*Shelled raw seed meal*	*Shelled cooked seed meal*		*Shelled seed meal*	*Whole fruit*
Total soluble carbohydrates (%)	4·0	2·6	9·6	18·4	17·1	17·8	—	—	—
Total reducing sugar (%)	1·15	1·16	1·12	1·15	1·31	1·24	—	2·25	12·50
Gross energy values (kcal/g)	10·54	8·47	5·88	5·62	7·61	7·95	—	—	—
Refractive index at 28°C	1·4717	—	—	—	—	—	1·4697	—	—
Iodine number	17·9	—	—	—	—	—	17·6	—	—
Saponification number	92·6	—	—	—	—	—	98·2	—	—

are shown in Table 2. The iodine numbers are higher than corresponding values for butter fat (26–38). The saponification numbers of 92·6 and 98·2 for *B. paradoxum* and *Tithonia* sp. oils, respectively, are, however, close to the range for corn fat (87–93). These constants are suggestive of the fact that these lipids have low degrees of unsaturation and contain higher molecular weight fatty acids containing 18 and more carbon atoms (Maynard & Loosli, 1969).

The range of total soluble carbohydrate contents was between 2·6% in defatted *B. paradoxum* and 18·4% in cooked *C. pepo* pulp meal. The values for raw and cooked *C. pepo* meals and *M. pruriens* beans compare well with the range of values for rice processing by-products which was 9·91% to 18·2% for rough and soft bran grades I and II (Farinu, 1980). The high content of total reducing sugars (12·5%) in the whole fruit of *Strychnos spinosa* reflects its use as a thirst breaker by hunters and farmers.

Of the mineral contents (Table 1), potassium appears the most abundant in the samples analysed, with values ranging between 0·13% for cooked mucuna seed meal and 1·34% for raw *L. aegyptiaca* shelled seed meal. Sodium contents were low.

Although the fat from *B. paradoxum* is already being used for cooking, and despite the similarities between this and the oil from *Tithonia* seeds, further studies on their fatty acids composition and feeding values to laboratory animals should be undertaken. Also, such materials as *Tithonia* seeds and *Mucuna* beans, with relatively high crude protein, should be investigated for possible uses as protein supplements for monogastric animal feeding.

REFERENCES

AOAC (1975). *Official methods of analysis.* (12th edn), Association of Official Analytical Chemists, Washington, DC.

Farinu, G. O. (1980). *Evaluation of some rice processing by-products as protein and energy sources for poultry.* Unpublished MSc Thesis, University of Ibadan, Ibadan.

Fetuga, B. L., Babatunde, G. M. & Oyenuga, V. A. (1973). Protein quality of some Nigerian feedstuffs I: Chemical assay of nutrients and amino acids composition. *J. Sc. Fd. Agric.* **24**, 1505–14.

Fetuga, B. L., Babatunde, G. M. & Oyenuga, V. A. (1974). Composition and nutritive value of cashewnut to the rat. *J. Agric. Fd. Chem.* **22**(4), 678–82.

Gohl, B. (1981). In: *Tropical feeds—Feed information summaries and nutritive values*, FAO.

Johnson, G., Johnson, D. K., Lambert, C. & Sunderwith, S. G. (1964). Colorimetric determination of glucose, fructose, and sucrose in plant materials using a combination of enzyme and chemical methods. *J. Agric. Fd. Chem.* **12**, 216–23.

Maynard, L. A. & Loosli, J. K. (1969). The lipids and their metabolism. In: *Animal nutrition*. (6th edn), McGraw-Hill, NY, 90–92.

Nelson, N. (1944). A photometric adaptation for the Somogyi method for the determination of glucose. *J. Biol. Chem.* **153**, 375–80.

Somogyi, M. (1945). A new reagent for the determination of sugars. *J. Biol. Chem.* **160**, 61–68.

G. O. Farinu
Department of Biochemistry,
University of Ilorin,
Ilorin, Nigeria

(Received 16 October 1985; accepted 23 April 1986)