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Technical Note

Proximate Composition and Chemical Assay of the Methionine, Lysine and Tryptophan Concentrations of Some Forest Tree Seeds

ABSTRACT

The proximate compositions of the seeds of twenty-five species of tree were determined and methionine, lysine and tryptophan were colorimetrically estimated. The lowest crude protein value (8·8%) was obtained in Afzelia bella *(calyx) while* Parkia clappertoniana *had the highest value (33·2%). Extractable lipids ranged from 1·0% in* Cassia nodosa *to 47·8% in* Khaya senegalensis. *The highest value of crude fibre (26%) was obtained in* Tectona grandis *while* Cassia siemea *had the highest ash value (9·7%). Nitrogen-free extract ranged from 21·6% for* Jatropha curcas *to 85·4% for* Afzelia bella *(calyx). The highest values of 4·19 g/16 g N for methionine, 8·70 g/16 g N for lysine and 3·10 g/16 g N for tryptophan were obtained in* Tectona grandis, Afzelia pachyloba *and* Khaya ivorensis, *respectively.*

INTRODUCTION

The urgency of the world food problem has presented a challenge to nutritionists to investigate the possibility of utilising some lesser known tree crop seeds as additional sources of protein. It has been observed that the seeds of *Afzelia bella* and *Parkia clappertoniana* are used as condiments in stews in several parts of Nigeria. Specific enquiries regarding the value of other forest tree seeds revealed that *Abrus*

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precatorus, *Afzelia africana*, *Amphimas pterocarpoides*, *Azadirachta indica*, *Jatropha curcas*, *Monodora tenuifolia* and *Pterocarpus osun* are being employed by natives for medical purposes. Although these seeds are consumed either to cure snake poison, convulsion, fever, mouth and skin infections or as mnemonic concoctions, it is also likely that they may contribute some nutrients.

In attempts to assess quantitative nutrient intake by several segments of the population, the contributions of these lesser known crops are usually ignored because of a complete absence of information about them. The present paper reports on preliminary analyses of some selected species including the determination of three amino acids found to be limiting in conventional foods.

MATERIALS AND METHODS

Sample collection and preparation

Twenty-five forest tree seeds were collected, in collaboration with the Forestry Research Institute, Ibadan, from the forest zone of southwestern Nigeria. Seeds from each tree were pooled and dried in an oven at 55 °C for 72 h. The dried seeds were milled to a powdery meal in a small laboratory milling machine. The meals were further dried to constant weight at 105 °C for 24 h (AOAC, 1975).

Chemical analyses

The Kjeldahl method was used to determine nitrogen (AOAC, 1975). Crude protein was calculated by multiplying percentage nitrogen by 6·25. Fat was extracted with hexane (Soxhlet method). Ash was determined after extensive combustion (600 °C for 6 h). The trichloracetic acid digestion reagent method (AOAC, 1975) was employed for crude fibre determination. The percentage crude protein, fat, ash and crude fibre were summed and subtracted from 100 % to obtain the per cent nitrogen-free extract (NFE). Methionine, lysine and tryptophan were assayed chemically by the colorimetric methods of McCarthy & Sullivan (1941), Selim (1965) and Miller (1967), respectively.

RESULTS AND DISCUSSION

The proximate compositions of the twenty-five forest tree seeds are shown in Table 1. Crude protein (CP) ranged from 8·8 % in the calyx of *Afzelia bella* to 33·2 % in *Parkia clappertoniana*. The lowest CP values of 8·8 %, 9·2 % and 10·1 %, respectively obtained in *Afzelia bella* (calyx), *Tectona grandis* and *Khaya ivorensis* closely approximate those reported (Oyenuga, 1968) for maize (10·65 %), millet (9·02 %) and rice grain (11·17 %). Ten of the forest tree seeds have CPs higher than 20 %, a value which compares favourably with the crude protein of cowpea seed, *Vigna*

TABLE 1
Proximate Composition of Some Nigerian Forest Tree Seeds

	Crude protein (%)	*Ether extract* (%)	*Ash* (%)	*Crude fibre* (%)	*Nitrogen-free extract* (%)
Abrus precatorus	22·4	3·5	2·2	15·5	56·4
Afzelia bella (calyx)	8·8	2·5	1·4	1·9	85·4
Afzelia bella (seed)	15·8	29·7	7·6	10·4	36·5
Afzelia africana	19·8	2·5	3·9	8·8	65·0
Afzelia pachyloba	12·2	25·2	3·2	4·3	55·1
Adnanthera pavoriana	17·6	32·8	2·4	8·7	38·5
Amphimas pterocarpoides	15·4	2·5	5·6	5·6	70·9
Antiaris africana	30·1	2·2	3·1	7·2	57·4
Azadirachta indica	12·8	9·6	4·3	18·8	54·5
Cedrela odorata	29·3	20·5	6·8	4·2	39·2
Cassia nodosa	16·0	1·0	1·8	16·4	64·8
Cassia siemea	23·4	12·3	9·7	9·2	45·4
Cassia sieberiana	20·2	13·1	3·3	7·1	56·3
Carapa procera	18·2	13·3	8·9	9·4	50·2
Delonix regia	20·2	2·5	6·8	19·6	50·9
Entolobium cyclocapum	24·7	3·7	4·9	14·8	51·7
Jatropha curcas	23·6	29·8	3·2	21·8	21·6
Khaya ivorensis	10·1	17·4	3·8	22·9	45·8
Khaya senegalensis	13·9	47·8	5·6	7·8	24·9
Mansonia altissima	18·2	35·6	4·9	4·3	37·0
Monodora tenuifolia	17·4	23·9	5·9	18·9	33·9
Parkia clappertoniana	33·2	16·7	6·8	20·8	22·5
Pterocarpus osun	32·4	19·5	6·2	19·4	22·5
Tectona grandis	9·2	26·5	3·4	26·0	34·9
Tectrapleura tetraptera	18·2	3·5	2·1	17·2	59·0

ungniculata Walp (24·67 %), and groundnut seed, *Arachis hypogea* Linn (27·20 %), as reported by Oyenuga (1968) and Njike (1973). These values suggest that many of the forest tree seeds may have a high potential as protein concentrate in foods.

Extractable fat (EE) ranged from 1·0 % for *Cassia nodosa* to 47·8 % for *Khaya senegalensis*. The seeds of *Afzelia bella*, *Afzelia pachyloba*, *Adnanthera pavoriana*, *Jatropha curcas*, *Khaya senegalensis*, *Mansonia altissima* and *Monodora tennifolia* which recorded more than 23 % EE similarly contained a fair percentage of protein, such that calorie/protein ratios of about 2:1 are obtained. The high fat content in most of the samples and the narrow calorie/protein ratios in some suggest that a greater percentage of these tree crop seeds could be used for preparing high energy containing foods.

Crude fibre (CF) varied from 1·9 % in the calyx of *Afzelia bella* to 26·0 % in *Tectona grandis*. The CF levels of *Afzelia bella* (calyx), *Afzelia pachyloba*, *Cedrela odorata* and *Mansonia altissimas* are similar to the 5·15 % reported (Oyenuga, 1968) for green gram seed, while those of *Tectona grandis*, *Delonix regia*, *Jatropha curcas* and *Khaya ivorensis* are similar to the value of 24·03 % reported (Oyenuga, 1968) for African locust bean pod. The high CF obtained in most of the samples may be caused by their fibrous seed coats which were not removed before preparing the materials into meals. Ash ranged from 1·4 % in *Afzelia bella* (calyx) to 9·7 % in *Cassia siemea* while nitrogen-free extract (NFE) varied from 21·6 % in *Jatropha curcas* to 85·4 % in *Afzelia bella* (calyx).

Table 2 shows the methionine, lysine and tryptophan concentrations of the seeds as determined. Methionine concentration ranged from 0·82 g/16 g N for *Pterocarpus osun* to 4·19 g/16 g N for *Tectona grandis*. *Afzelia bella* (calyx) and *Tectona grandis*, with the lowest CP values, tended to have the highest concentrations of 4·10 and 4·19 g of methionine per 16 g of nitrogen, respectively. Methionine appeared to be fairly abundant in *Afzelia bella* (seed), *Amphimas pterocarpoides*, *Cassia nodosa* and *Khaya ivorensis*; however, their values might have been influenced by histidine and tryptophan which were reported (Csonka & Denton, 1946) to interfere with methionine determination. Lysine concentration ranged from 3·75 g/16 g N for *Cedrela odorata* to 8·70 g/16 g N for *Afzelia pachyloba*. These values are better than the 2·30 g/16 g N reported (Oyenuga, 1968) for maize and 2·60 g/16 g N for guinea corn. However, they compare favourably with the 7·36 g/16 g N, 6·90 g/16 g N, 6·50 g/16 g N and 6·24 g/16 g N reported, respectively

TABLE 2
Methionine, Lysine and Tryptophan Concentration in Some Nigerian Forest Tree Seeds (g/16 g N)

	Methionine	*Lysine*	*Tryptophan*
Abrus precatorus	2·38	5·82	2·48
Afzelia bella (calyx)	4·10	4·96	1·55
Afzelia bella (seed)	3·17	6·08	1·99
Afzelia africana	2·31	4·76	2·18
Afzelia pachyloba	2·66	8·70	2·67
Adnanthera pavoriana	2·08	5·23	1·57
Amphimas pterocarpoides	3·09	6·11	1·91
Antiaris africana	1·25	4·45	0·99
Azadirachta indica	1·73	6·23	3·00
Cedrela odorata	1·31	3·75	1·08
Cassia nodosa	3·06	6·75	2·00
Cassia siemea	2·28	5·82	1·65
Cassia sieberiana	2·63	4·55	0·90
Carapa procera	1·23	6·14	1·88
Delonix regia	3·11	6·03	1·45
Entolobium cyclocapum	1·98	5·09	1·21
Jatropha curcas	2·26	5·34	1·15
Khaya ivorensis	3·68	6·92	3·10
Khaya senegalensis	2·40	6·90	2·87
Mansonia altissima	1·79	4·52	1·75
Monodora tenuifolia	2·13	5·65	1·84
Parkia clappertoniana	1·29	4·76	1·04
Pterocarpus osun	0·82	4·01	2·50
Tectona grandis	4·19	7·60	1·45
Tectrapleura tetraptera	2·87	6·80	1·81

(Oyenuga, 1968) for *Pisum sativum*, *Phaseolus linatus*, soybean meal and cowpea. Tryptophan concentration ranged from 0·90 g/16 g N for *Cassia sieberiana* to 3·10 g/16 g N for *Khaya ivorensis*. This range is higher than that reported (Tewe & Fetuga, 1979) for some agro-industrial by-products.

CONCLUSION

These results suggest that the seeds of several of the species studied show promise as protein concentrates and, if suitably processed, they could

become a good source of human food. It is to be noted, however, that the high fibre level associated with high crude protein and oil in some samples may reduce the availability of nutrients and therefore limit their use in monogastric feeding. An assessment of potential toxic components would also have to be carried out to ascertain that they present no health hazard.

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