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The Nutrient Composition of the 'Afon' Diet—Nigerian Cooked Testa-free Seeds Prepared from the Fruit of *Treculia africana*

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ABSTRACT

'Afon' diet was prepared in the laboratory in the traditional way from the seeds of Treculia africana. *The raw, parboiled and cooked seeds were analysed with respect to their moisture, protein, fat, soluble carbohydrate, fibre and mineral contents. The cooked seeds provide about 180 g kg^{-1} protein. However, the levels of the most important dietary constituents like calcium, phosphorus and iron were very low in all the samples, especially those of the cooked seeds. Significant amounts of carbohydrate (750 g kg^{-1} dry matter) were found in the 'afon' diet; the sucrose content was 20 g kg^{-1} dry matter. Microscopic examination showed that starch granules were absent in the samples. The production and increased consumption of the 'afon' diet should be encouraged in Nigeria.*

INTRODUCTION

Treculia africana is a tropical edible plant found in Africa. It is often called the African breadfruit tree because of its large fruits and edible seeds. The fruit has a great potential as a source of food because it is very prolific. In the context of the poor economic situation in Nigeria, the 'afon' diet can be considered an important contributor to meeting the dietary requirements of the people. The work described in this paper was therefore embarked upon to estimate the nutrient content of the 'afon' diet for the purpose of

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providing data for the future compilation of Nigeria's Food Composition Tables.

MATERIALS AND METHODS

Materials

The samples of the fruit of *Treculia africana* were obtained from Ishara-Remo in the Ogun State of Nigeria, where they are commonly found.

Two large fresh fruits, each of about 6 km in weight and 0·45 m in diameter, were allowed to soften by placing them in water in large containers. After 5 days, the seeds, which were embedded in the spongy pulp of the fruits, were extracted. These seeds were washed with water. They are referred to in this work as the raw seeds. Some of the seeds were pounded in a mortar into a homogeneous slurry and samples were taken for dry matter determination. The rest of the slurry was dried in air, then stored in sealed cellophane bags in a refrigerator.

The remaining raw seeds were boiled in water for 15 min. The boiling water was discarded and the seeds were allowed to cool. Then the boiled seeds were dried in the sun for 2 days, after which the seed-coats were removed with the aid of small stones, thus exposing the white cotyledons. These white seed cotyledons were then boiled in water for a further 10 min. The boiling water was also discarded and the material was left to cool. The white cotyledons of the seeds are referred to as parboiled seeds.

Samples of the parboiled seeds were taken for dry matter determination. The rest of the parboiled seeds were dried in the sun for 2 days, pounded in a mortar into white powder and then stored in sealed cellophane bags in a refrigerator.

The cooked diet was prepared by further boiling of the parboiled seeds in water until the boiling water almost dried up. The soft cotyledon material was then broken up into small pieces and made into a paste. This white paste is sweet smelling and is called 'afon' diet (cooked 'testa-free' seeds).

Samples of the cooked seeds were taken for dry matter determination in the laboratory. The rest of the cooked seeds were stored in large plastic covered vessels at $-20°C$ in the freezer until required.

The procedures carried out for the determination of moisture, protein, fat, crude fibre and ash were based on the standard techniques adopted by the Association of Official Agricultural Chemists (AOAC, 1970). The protein value was derived from the nitrogen content by multiplying by a factor of 6·25. The carbohydrate values were computed by difference by subtracting from 100 the sum of the moisture, protein, fat, fibre and ash contents.

Total soluble carbohydrate was determined by the phenol–sulphuric acid method of Dubois *et al.* (1951).

The sugars were extracted by 80% ethanol. The extract was subjected to separation by paper chromatography using *n*-butanol, acetic acid and water (4:1:1 volumes) as mobile phase.

The sugars were identified using silver nitrate in acetone and ethanolic sodium hydroxide (Trevelyan *et al.*,1950) and naphthoresorcinol and trichloroacetic acid (Partridge, 1948). Sucrose, fructose, glucose, maltose and raffinose were found to be present in the raw seeds, parboiled seeds and the cooked 'testa-free' seeds ('afon' diet).

Mineral composition

The mineral composition was determined using the method of the AOAC (1970). Iron and phosphorus were estimated from the aliquots of the mineral solution colorimetrically, the former by the dipyridyl method and the latter by the quinol/sodium sulphite method (Yuen & Pollard, 1955). Sodium and potassium were determined by the flame photometric method. Calcium was precipitated as calcium oxalate and subsequently determined by titration against permanganate. Copper, manganese, magnesium and zinc were determined by atomic absorption spectrophotometry (AOAC, 1970).

RESULTS AND DISCUSSION

The proximate compositions of the raw seeds, parboiled seeds and cooked 'testa-free' seeds ('afon' diet) are shown in Table 1.

The results show that the seeds have appreciable amounts of protein and high lipid contents. The protein content of the cooked 'testa-free' seeds ('afon' diet) was 176 g kg^{-1} dry matter. The results obtained for the crude fat and crude protein agreed with the view expressed by Okafor (1975) that the seeds contain a reasonable amount of protein and lipid. Okafor, however, obtained 172 g kg^{-1} for the crude protein of the raw seeds and 103 g kg^{-1} for the fat content.

In the light of the data presented in Table 1, if the total intake of the cooked 'testa-free' seeds ('afon' diet; three meals a day), for an average adult is 1000 g, this would be equivalent to 305·7 g dry matter of the material. This amount of the dried material would produce 53·7 g protein, 13·5 g lipid and 235·2 g carbohydrate. 53·7 g protein would release about 214·8 calories; 13·5 g lipid would release about 121·8 calories and 235·2 g carbohydrate would give about 940·9 calories, totalling 1277·6 calories. This amount of

TABLE 1
Chemical Composition of Raw Seeds, Parboiled Seeds and Cooked 'Testa-free' Seeds ('Afon' diet)

Sample	*Dry matter* (%)	*Values* ($g\,kg^{-1}$ *dry matter*)[a]				
		Protein	*Crude fat*	*Ash*	*'Available' carbohydrate*	*Crude fibre*
Raw seeds	60 ± 2·0	144 ± 5·0	106 ± 0·4	67 ± 2·0	637 ± 3·0	47 ± 1·5
Parboiled seeds	40 ± 1·3	177 ± 6·0	71 ± 2·0	41 ± 2·0	674 ± 2·0	32 ± 3·0
Cooked 'testa-free' seeds ('afon' diet)	30 ± 1·0	176 ± 6·0	44 ± 1·0	11 ± 4·0	754 ± 0·03	15 ± 6·0

[a] Mean value of four determinations ± standard deviation.

calories is equivalent to 50% of the daily requirement of a growing child (Indusogie, 1971). It may be necessary for Nigerians (particularly those living in the forest zone) to increase the production and consumption of 'afon' diet (cooked 'testa-free' seeds) to supplement other foodstuffs like cereals and legumes which are widely consumed in many villages in Nigeria.

Table 2 shows the individual sugar contents of the raw seeds, parboiled seeds and cooked 'testa-free' seeds obtained after chromatography. The total sugar content of all the samples was very low. The paper chromatography of the ethanolic extract of the samples revealed that sucrose, glucose, fructose, maltose and raffinose were the only detectable sugars. The presence of the reducing sugars was also shown by Benedict's volumetric method (see Dubois *et al.*, 1951).

There is no evidence of the presence of starch in the raw seeds. The iodine stain test was negative. Microscopic examination showed that starch granules were not present in the material.

The results in Table 2 show that sucrose was the predominant sugar in the seeds. The values of glucose and fructose in all the samples were almost

TABLE 2
The Total Sugar Content of the Raw Seeds, Parboiled Seeds and Cooked 'Testa-free' Seeds of *Treculia africana*
(Values[a] are expressed in mg $100\,g^{-1}$ dry matter)

Sample	*Glucose*	*Fructose*	*Sucrose*	*Maltose*	*Raffinose*
Raw seeds	1·13 ± 0·04	1·11 ± 0·04	2·37 ± 0·08	0·18 ± 0·00	0·36 ± 0·00
Parboiled seeds	0·98 ± 0·03	0·88 ± 0·03	2·06 ± 0·07	0·16 ± 0·00	0·33 ± 0·00
Cooked 'testa-free' seed ('afon' diet)	1·18 ± 0·04	1·08 ± 0·04	2·00 ± 0·07	0·12 ± 0·00	0·30 ± 0·00

[a] Mean value ± S^D of four different determinations.

TABLE 3

Mineral Composition of the Raw Seeds, Parboiled Seeds and Cooked 'Testa-free' Seeds of *Treculia africana* (Values[a] are expressed as mg $100\,g^{-1}$ dry matter)

Raw seeds	$261 \pm 0{\cdot}9$	$283 \pm 0{\cdot}9$	$15 \pm 0{\cdot}1$	$139 \pm 0{\cdot}5$	$0{\cdot}17 \pm 0{\cdot}00$	$0{\cdot}89 \pm 0{\cdot}00$	$0{\cdot}86 \pm 0{\cdot}00$	$90 \pm 0{\cdot}3$	$0{\cdot}11 \pm 0{\cdot}00$
Parboiled seeds	$235 \pm 0{\cdot}8$	$255 \pm 0{\cdot}9$	$12 \pm 0{\cdot}1$	$121 \pm 0{\cdot}4$	$0{\cdot}11 \pm 0{\cdot}00$	$0{\cdot}85 \pm 0{\cdot}00$	$0{\cdot}60 \pm 0{\cdot}00$	$70 \pm 0{\cdot}2$	$0{\cdot}10 \pm 0{\cdot}00$
Cooked 'testa-free' seeds	$204 \pm 0{\cdot}7$	$243 \pm 0{\cdot}8$	$10 \pm 0{\cdot}1$	$90 \pm 0{\cdot}00$	$0{\cdot}10 \pm 0{\cdot}00$	$0{\cdot}81 \pm 0{\cdot}00$	$0{\cdot}46 \pm 0{\cdot}00$	$61 \pm 0{\cdot}2$	$0{\cdot}09 \pm 0{\cdot}00$

[a] Mean values $\pm S^{o}$ of four determinations.

the same. These findings agree with the view expressed by Sinclair & Hollingsworth (1969) that, in acid solution, such as in stewed fruits and jams, heat caused 'inversion' of sucrose into glucose and fructose.

The mineral compositions of the raw seeds, parboiled seeds and cooked 'testa-free' seeds are shown in Table 3. The levels of the most important dietary constituents like calcium and phosphorus were very low in all the samples especially those of the cooked 'testa-free' seeds ('afon' diet).

The results (Table 3) show that sodium and potassium were, however, more abundant than other elements in all samples. Although the values obtained for the latter elements in the 'afon' diet were low, the diet can still provide mineral elements, especially the trace elements. Work is in progress to evaluate the nutritional values of the 'afon' diet by *in vivo* studies with rats.

CONCLUSIONS

The preparation of the 'afon' diet in the forest zone of Nigeria has been described. However, there is the need for improvement in this method of preparation of the diet, so that the nutrient losses can be reduced to a minimum. This crop should be studied further with respect to its use as a food.

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