The Journal of Food Technology in Africa, ISSN: 1028-6098

Innovative Institutional Communications

The Journal of Food Technology in Africa Vol. 7 No. 3, 2002, pp. 82-84

Investigation into the lesser known Pulse - *Canavalia ensiformis*: Chemical composition and Fatty acid profile

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ABSTRACT

Investigation into the proximate composition, mineral and fatty acid contents of *Canavalia ensiformis* have been carried out. The moisture content was 9.2% while crude oil, crude protein, crude fibre and carbohydrate contents were 2.8%, 28.6%, 5.3% and 51.3% respectively. Potassium, phosphorous and calcium were the most abundant minerals. Other mineral elements determined were sodium magnesium, iron, copper, zinc and manganese. The major fatty acids of the seed oil include palmitic acid (16.4%), oleic (45.7%) and linoleic acid (20.3%). Others include palmitoleic acid (3.1%), stearic acid (8.6%) and linolenic acid (5.9%). The essential fatty acid content was higher than found in some other pulses.

Keywords: - Pulses, *Canavalia enisformis*, Proximate analysis.

INTRODUCTION

The fast growing population of sub-Saharan Africa has made it necessary to search for new sources of protein to feed the population, for which pulses are noted. One of such sources is the less known seed plant, *Canavalia ensiformis* (also called sword bean). It is found in the tropics and in West Africa, grows from Senegal to Nigeria. It is a shortlived, climbing, perennial plant of the family leguminocae, tolerant to a wide range of rainfall and soil conditions (Irvine, 1969).

The pods are large and sword-shaped, up to 12 inches long, and flat with two longitudinal ribs along their upper edge, with between 8 and 20 white (or at times red or yellowish), smooth, elliptical, tough-skinned seed, each about x inches in size with an average weight of 2-2gram. The young pods are eaten as a vegetable. The mature seeds are consumed in some area in India (Vishnu, 1981) and around the Plateau State of Nigeria after cooking.

There has been some reports on *C. ensiformis* (Gunstone *et. al.*, 1968; Leon *et. al.*, 1989; Rodrigues and Tome, 1991; Mohan and Janardhanan, 1994) but there is paucity of data on it in Nigeria, and it is known that chemical composition of agricultural products may vary according to variation in soil and climate among other factors (Oyenuga, 1968). The present study attempts to evaluate the chemical composition of this less known pulse in Nigeria, and to assess the nutritional value for man or as animal feed.

MATERIALS AND METHODS

The matured seeds of *C. ensiformis* were collected from a garden farm in Osogbo and another in Iree, both in Osun State, Nigeria. 500g seeds from each of the two sampling sites were mixed and aliquots ground for analysis. The contents of moisture, ash, crude oil and crude fibre were determined by the AOAC (1990), crude protein by multiplying the percentage Kjeldahl nitrogen by a factor of 6.25 and carbohydrate obtained by difference.

Mineral elements were determined by digesting the ash with 3M hydrochloric acid and using the flame photometer for sodium and potassium and the atomic absorption spectro-photometer for calcium, copper magnesium, manganese and zinc, (Adeyeye and Ajewole, 1992).

Phosphorous was determined colorimetrically, using the phosphovanado molybdate method (AOAC, 1990).

Methyl esters were prepared from the crude oil extract using boron trifluoridemethanol reagent (Malcaife &

Schmitz, 1961). The fatty acid methyl esters so prepared were chromatographed using 10% DEGS on Chromosorb WHP packed in glass column (200cm x 4mm id) on a Varian 3700 gas chromatograph equipped with a flame ionization detector and column temperature were 220, 270 and 190°C isothermal, respectively and nitrogen as carrier gas flowing at 30ml/min. Peaks of the methyl esters were identified by comparing their retention times with those of authentic standards under the same operating conditions. The peak areas were measured by triangulation and the relative proportion of the individual compound obtained by determining the partial area in relation to total area.

RESULTS AND DISCUSSION

The result of the proximate analysis of the seed sample of *C. ensiformis* is shown in [Table 1](#). This gave a high crude protein content (28.62%) which is comparable or greater than found in many common pulses in Nigeria, such as *Vigna unguiculata*, *Cajanus cajan* and *Phaseolus lunatus* (Oyenuga, 1968; Nwokolo, 1987). The oil content was low (2.8%) and similar to what obtained in many other pulses found in Nigeria (Oyenuga, 1968). The crude protein and carbohydrate contents compare well with those found in India but the oil content was much lower (Mohan & Janardhanan, 1994).

The mineral element composition of the seeds of *C. ensiformis* is as shown in [Table 2](#). The most predominant was potassium, followed by phosphorous, calcium, magnesium and sodium in that order, Iron, Copper, Zinc and manganese were found at much lower levels. The contents of magnesium and phosphorous were higher but those of potassium and calcium were lower than found in India (Mohan and Janardhanan, 1994). The seed was a richer source of sodium, potassium and calcium when compared with other more common pulses, (Oyenuga, 1968; Paul and Southgate, 1978.)

The fatty acid profile of the crude oil of the investigated seeds of *C. ensiformis* appears in [Table 3](#). As with most plant seed oils, palmitic, oleic and linoleic acids were predominant (Adeyeye and Ajewole, 1992). There is a good content of essential fatty acids (C18: 2 & C18:3). The level of linolenic acid makes the seed to be nutritionally significant when compared with many other pulses, as its content was higher than found in *Cajanus cajan* (Salunkhe *et. al.*, 1982) and *Glycine max* (Ologhobo and Fatuga, 1984).

In the developing countries, pulses are important sources of dietary protein. However, there are limitations as to their acceptability because of the presence of certain anti-nutritional factors. Mohan and Janardhanan (1994) has reported low levels of tannin, free phenols and L-DOPA in *C. ensiformis* and the presence of canavanine in it has

been well established (Leon *et. al.*, 1989; Rodrigues and Tome 1992) Canavaine is toxic and its consumption can be fatal (Rodrigues and Tome, 1991).

The chemical composition of the seed of *C. ensiformis* revealed a good source of crude protein, certain minerals and essential fatty acids, especially when compared with some of the commonly consumed pulses in Nigeria. It thrives in most soils. It is disease and drought resistant and can be grown in loamy soils with low rainfall. These suggest that it might be capable of providing food in marginal areas in the tropics where other pulses would fail. However, in view of the antinutritional constituents, its seed meal should be thoroughly cooked before consumption.

Repeated soaking followed by boiling has been suggested as a means of reducing the canavanine content to tolerable limits.

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Table 1. Proximate composition of *Canavalia ensiformis* (% dry matter).

	%DM
Moisture (wet weight basis)	9.18
Crude protein	28.62
Crude oil	2.79
Crude fibre	5.32
Ash	2.84
Carbohydrate	51.25

* Average of three determinations.

Table 2. Mineral composition of *Canavalia ensiformis*

	Mg/100g
Sodium	62.4
Potassium	960.5
Calcium	177.0
Magnesium	94.6
Phosphorus	302.0
Iron	4.27
Copper	0.85
Zinc	1.76
Manganese	0.55

* Average of 3 determinations.

Table 3. Fatty acid and profile of the seed oil of *Canavalia ensiformis*

	(% total)
Palmitic	16.4
Palmitoleic	3.1
Stearic	8.6
Oleic	45.7
Linoleic	20.3
Linolenic	5.9