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Chemical evaluation of the nutritive value of leaf of fluted pumpkin (*Telferia occidentalis*)

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The nutritive values of the leaf of fluted pumpkin has been evaluated chemically. The leaf was found to contain (g/100 dry wt) 30·5 + 2·5 crude protein, 3·0 + 0·15 crude lipid, 8·3 ± 0·50 crude fibre and 8·4 ± 0·50 total ash. The potassium, calcium, magnesium and iron contents of ash were 594, 144, 100 and 12·0 mg/100 g dry wt, respectively. The leaf was found to have a high level of tannic acid but the levels of phytic acid and oxalate were within the normal range. The leaf has an excellent ratio of essential amino acids to total nitrogen. Methionine was found to be the limiting amino acid with a chemical score of 16.

INTRODUCTION

The Food and Agriculture Organization of the UN has determined that the food consumed by people in developing countries is deficient in protein, both in quality and quantity, and this causes widespread malnutrition and undernutrition. It has been suggested that the obvious remedy is to eat more of the conventional protein-rich food such as meat, fish and poultry products. However, the poor state of economy in developing countries has made consumption of high protein foods out of reach of more than 70% of people. The only solution, therefore, is to use unconventional sources of protein, leaf protein, to supplement diet as a means of alleviating protein shortage.

Studies on leaf protein have shown their potential for supplying good-quality food proteins (many times greater than would be obtained with cereals, legumes and oil seeds) (Subba Rau *et al.*, 1972). Studies have also shown that not all leaf proteins are of good quality. Those that produce a weight gain of 25 g in four weeks when fed to laboratory animals are generally regarded as good-quality leaf protein (Subba Rau *et al.*, 1972). Some of these vegetables are available in developing countries.

Consumption of the majority of locally available vegetable in Nigeria is limited by the complete lack of adequate information on their nutritive values. In other words, the pace of progress in nutritional work is limited by the apparent lack of information on the chemical and biological constituents of these locally available vegetables.

Fluted pumpkin (*Telferia occidentalis*) is a creeping plant cultivated and consumed widely in West Africa. The plant produces a single pod with many seeds which are grown during the wet season. The leaf of the plant is widely used for making a vegetable soup. The present study was designed to evaluate the nutritive value of the plant by chemical analysis as part of its nutritional evaluation.

MATERIALS AND METHODS

Collection of fluted pumpkin leaves for analysis

The leaves of fluted pumpkin were purchased from 20 vegetable farms 2 km from one another and 15 different markets in Jos.

Proximate analysis

The leaves were pooled, cut, dried at 70°C and milled (AOAC, 1983). Crude lipid, crude protein (N × 6·25), total ash and moisture values were determined using AOAC (1983) procedures. Crude fibre was estimated on the defatted sample by the method of Joslyn (1970). The amino-acid composition was determined by the method of Spackman and Moore (1958) using norleucine as an internal standard, tryptophan and cysteine by the acid ninhydrin method of Gaitonde (1967). For determination of elements (Na, K, Mg, Ca, Zn and Fe), the sample was digested in $HNO_3/HClO_4$ (9 : 1) as described by Harris (1970). They were measured by atomic absorption spectrophotometer (AAS) using an acetylene-air flame. Phytic acid was determined as phytic phosphate by the modified method of McCance and Widdowson (1935), soluble oxalate by the method of Abeza *et al.* (1968) and tannic acid by the AOAC (1983) procedure.

RESULTS AND DISCUSSION

The proximate composition of fluted pumpkin leaf is given in Table 1, the antinutritional factors in Table 2 and the amino acid composition in Table 3. The moisture content (80 g/100 g) suggests that the leaf loses considerable amount of water and may not keep for long at room temperature. The ash content of 8·4 g/100 g is within the range reported for watercress and spinach (Oyenuga, 1968) and sorrel leaf (Ladeji & Okoye, 1993). The crude lipid (3 g/100 g) is lower when compared with cocoyam leaf but higher than in bitter-leaf or spinach (Oyenuga, 1968). The value for crude protein (30·5/100 g) was considerably higher than the values reported for most common vegetables (Bush & Robertson, 1984; Ladeji & Okoye, 1993). The sodium, potassium, magnesium and calcium contents of the leaf (Table 1) were higher when compared with vegetables such as lettuce, cabbage, spinach and okra (Bush & Robertson, 1984) but lower than the value reported for sorrel (Ladeji & Okoye, 1993).

Table 1. Proximate composition of *T. occidentalis* (moisture content 80·0 g/100 g fresh weight; mean of six determinations ± SD)

Component[a]	Concentration (g/100 g dry wt)
Total ash	8·40 ± 0·50
Crude lipid	3·0 ± 0·15
Crude protein	30·5 ± 2·50
Crude fibre	8·30 ± 0·50
Nitrogen-free extract	52·5 ± 2·60
	mg/100 g dry wt
Sodium	9·0
Potassium	594
Calcium	144
Magnesium	100
Zinc	5.0
Iron	12.0

[a]Means of four determinations ± SD.

Table 2. Antinutritional factors in the leaf of *T. occidentalis* (mg/100 g[a])

Antinutritional factor	mg/100 g (dry weight)
Oxalic acid (total)	0·45 ± 0·03
Oxalic acid (soluble)	0·22 ± 0·02
Tannic acid	4·75 ± 0·50
Phytic phosphate	20·5 ± 2·10

[a]Values are means of four determinations ± SD.

Except for the slightly high level of tannic acid which may form complexes, not only with dietary proteins but also with digestive enzymes, thus reducing the digestibility of protein in foods (Singh & Eggum, 1984), the levels of soluble oxalate and phytic acid were lower than the values reported for other vegetables (Oke, 1969). The level of phytic acid was also far below the level reported present in adult meal to avoid negative effects on zinc and iron absorption (Sandberg, 1990); the levels of these antinutrient factors may further be reduced by thorough washing prior to cooking (personal observation by the author). Comparing the essential amino acids/total nitrogen ratio of the leaf to that of the FAO provisional pattern (2·50) it was found that the leaf is rich in essential amino acids. Comparison with the recommended amino-acid pattern (FAO, 1985) shows that the limiting amino acid in the leaf is methionine with a score of 16%. The leaf is rich in leucine, lysine, threonine, valine and tyrosine. The high protein content in the leaf of *T. occidentalis*, the excellent ratio of essential amino acids to total nitrogen and the low levels of antinutritional factors seem to suggest that the leaf of *T. occidentalis* may be a good substitute for animal protein and consumption of the leaf as a vegetable may help to minimize protein malnutrition prevalent in developing countries.

Table 3. Amino acid composition of the leaf of *T. occidentalis* (g/100 g)[a]

Amino acid	Concentration in *T. occidentalis*	Chemical score
Ile	1·3 ± 0·03	31
Leu	3·3 ± 0·11	78·6
Lys	3·0 ± 0·10	71
Met	0·4 ± 0·02	16
Thr	1·5 ± 0·04	54
Phe	1·2 ± 0·06	43
Val	2·4 ± 0·20	57
Tyr	1·5 ± 0·10	54
Trp	0·55 ± 0·02	39
Cys	1·5 ± 0·30	
Arg	2·2 ± 0·11	
His	1·4 ± 0·02	
Ala	2·1 ± 0·02	
Ser	1·9 ± 0·20	
Pro	1·9 ± 0·11	
Gly	2·1 ± 0·10	
Glu	4·8 ± 0·45	
Asp	2·6 ± 0·25	
Total AA	35·7	
Sum EAA	13·7	
Ratio of EAA to total nitrogen	2·4	
Chemical score (methionine)	16	

[a]Values are means of three determinations ± SD.

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