Proximate composition of bungu (*Ceratotheca sesamoides* Endl.) leaves and seeds

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Abstract

Proximate analysis of the leaves of bungu harvested at 7, 8, 9, and 10 weeks after planting and the mature seeds were carried out in respect of the major nutrients. Mean values determined in two cultivars of the crop species indicated that the leaves contain low soluble carbohydrates and fat in addition to substantial amounts of protein (29.35 - 29.85%) and total ash (9.38 - 11.13%). The amounts of these and other nutrients in the leaves varied with age. The seeds contain appreciable levels of fat (17.25 - 21.00%), suggesting that they are potentially capable of being exploited as source of vegetable oil. So also, the seeds contain high levels of crude protein (21.32 - 22.15%), crude fiber (25.75 - 29.5%), calcium (2.65 - 3.15%), and phosphorus (0.53 - 0.54%).

Key words: Bungu; proximate analysis; major nutrients

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INTRODUCTION

Leaf vegetables are known to add taste and flavour, as well as substantial amounts of protein, fiber, minerals, and vitamins to the diet (Oyenuga and Fetuga, 1975; Adeyemi, 1987). While the amounts of the nutrient constituents in the more commonly used leaf vegetable species in Nigeria have been studied to some extent (Oke, 1966; Oyenuga, 1968; Viyajakumar and Shanmugavelu, 1985; Taylor, 1988), the lesser known regional and local species remain virtually neglected. Lack of information on the specific nutrients in a large number of the native vegetables species with which Nigeria is richly endowed is partly responsible for their under-exploitation especially in areas beyond the traditional localities where they are found and consumed.

Amaranthus spp., *Celosia* spp., *Talinum triangulare*, *Corchorus olitorius*, *Telfairia occidentalis*, *Cucurbita pepo*, and *Vernonia amygdalina* are some of the commonly used leaf vegetable species in Nigeria on which proximate analysis studies have been conducted. Apart from the quantitative determination of specific nutrients in them, it has also been shown that the amount of a particular nutrient is influenced by the plant genotype, climate, soil fertility, age at harvest, and physiological changes during post-harvest handling (Earle and Jones, 1962; Oyenuga, 1968; Kane et. al., 1997).

Bungu, an important member of the family Pedaliaceae to which sesame or beniseed (*Sesamum indicum* L.) also belongs, is native to the northern parts of West Africa (Irvine, 1969; Zeven and de Wet, 1982). In Nigeria, it is widely distributed in variable forms and consumed as a leaf vegetable in the savanna ecological zones. Its mucilage-containing leaves are cooked directly in the soup, thus there is minimum nutrient loss. However, despite that

the leaves and seeds feature prominently in the diet of the indigenous peoples of the savanna zones, published information is scanty on its proximate composition. In order to ascertain the nutritive value of the crop species and thereby stimulate interest in its utilisation beyond the traditional localities, this study was designed to determine the levels of the major nutrients in the leaves and seeds.

MATERIALS AND METHODS

Edible leaves harvested at 7, 8, 9, and 10 weeks after planting (WAP) and the mature seeds of two bungu cultivars were obtained for proximate analysis from purposely planted plots on the University of Ilorin Teaching and Research Farm in September 1998. The two cultivars (code-named Lrn/09 and Lrn/10) were chosen from among 18 collections from different parts of Nigeria: Lrn/09 represented the tall morphotypes and Lrn/10, the dwarfish types.

Leaf samples were harvested at weekly interval from two randomly selected rows per designated plot beginning at 7 WAP. Seed samples were obtained when about 50% of the fruits on the main stem showed physiological maturity; i.e. changed colour from green to yellow. The samples were oven-dried, in quadruplicate, at 60°C to a constant weight. Shortly before chemical analysis, the dried leaves were ground in an electric grinder and passed through a 2mm-sieve while the seeds were pounded to a fine meal in a small laboratory porcelain mortar. Water content was the difference in weight before and after oven-drying the fresh sample, and dry matter was the oven-dried weight.

Crude protein, fat (Ether Extract), crude fiber, and total ash contents were determined using the methods described by AOAC (1990). Carbohydrate (Nitrogen Free Extract) was determined by difference; i.e. the sum of the percentages of crude protein, fat, crude fiber, and total ash deducted from 100. Calcium was determined by the EDTA titration method (Hildebrand and Reilley, 1957) and phosphorous by the Ascorbic acid method (Jackson, 1969; Aldrich, 1986). The values determined were statistically analysed for variance and

Table 1: Percent Proximate Composition of the Edible Leaves of two Cultivars of *Ceratotheca sesamoides*

WAP	<u>Cultivar Lrn/09</u>				<u>Cultivar Lrn/10</u>				<u>Mean Composition</u>			
	<u>Ages at Harvest *</u>				<u>Ages at Harvest *</u>				<u>Cultivars *</u>			
	7	8	9	10	7	8	9	10	S. E.	Lrn/09	Lrn/10	S.E.
Nutrients Analysed												
Water	83.08a	81.28a	79.23b	78.23b	82.63a	80.78a	78.55b	79.28b	0.58	80.46a	80.31a	0.66
Dry Matter	16.93c	18.73b	20.78a	21.78a	17.38c	19.23b	21.45a	20.73a	0.58	19.56a	19.70a	0.66
<u>% of Dry Matter</u>												
Soluble Carbohydrates (NFE)	39.95b	50.58a	51.05a	49.68a	37.60b	50.13a	49.58a	51.30a	0.88	47.82a	47.15b	0.05
Crude Protein	33.68a	28.55b	28.33b	28.83b	34.65a	28.50b	28.18b	26.08b	0.72	29.85a	29.35b	0.09
Crude Fat (EE)	5.25a	4.00b	4.50b	4.50b	5.63a	4.25b	4.50b	4.00b	0.26	4.56a	4.60a	0.20
Crude Fiber	7.00b	7.25b	8.00b	10.38a	8.00b	7.75b	6.75b	9.13a	0.42	8.16a	7.91a	0.16
Total Ash	10.75a	8.88b	8.88b	9.00b	13.00a	10.88b	10.00b	10.63b	0.57	9.38b	11.13a	0.29
Calcium	1.93c	2.35bc	2.75b	3.35a	1.83c	2.20bc	2.55b	3.90a	0.22	2.60a	2.62a	0.12
Phosphorus	0.17b	0.24b	0.21b	0.39a	0.18b	0.24b	0.22b	0.44a	0.03	0.25a	0.27a	0.01

S. E. = Standard Error.

* Values in the same row of each cultivars or mean composition followed by at least one common letter are not significantly different at 5% level of the DMRT.

significantly different treatment means determined at 5% level using Duncan multiple range test (DMRT).

RESULTS AND DISCUSSION

The proximate analysis results in respect of the edible leaves are presented in Table 1. The ages mentioned in the text are the lengths of time from sowing to harvesting. Variation with age in the levels of the nutrients determined indicate that the percentages of crude protein, crude fat, and total ash in the leaves of the two cultivars were significantly higher at 7 than 8, 9, and 10 weeks. Conversely, dry matter, soluble carbohydrates, crude fiber, calcium, and phosphorous contents increased with age, their mean values being higher at 10 than 7 weeks. The decline in the levels of the major nutrients after 7 weeks may be attributed to the phenomenon, which Hewitt and Marrush (1986) described as assimilate remobilisation from the

Table 2 Percent Proximate Composition of the Mature Seeds of two Cultivars of *Ceratotheca sesamoides*

Nutrients Analysed	<u>Cultivars *</u>		
	Lrn/09	Lrn/10	S. E.
Water	5.00b	5.88a	0.13
Dry Matter	95.00a	94.13b	0.13
<u>% of Dry Matter</u>			
Soluble Carbohydrates (NFE)	20.60b	28.18a	0.94
Crude Protein	22.15a	21.32a	0.57
Crude Fat (EE)	21.00a	17.25b	0.18
Crude Fiber	29.75a	25.75b	0.50
Total Ash	6.50b	7.50a	0.50
Calcium	2.65a	3.15a	0.32
Phosphorus	0.53a	0.54a	0.09

S. E. = Standard Error.

* Values in the same row followed by the same letter are not significantly different at 5% level of the DMRT.

leaves to the reproductive organs during flowering and fruiting. In bungu, flowering in the two cultivars studied was observed to have started at about 8 weeks, reaching 50% stage at 9 - 10 weeks.

Mean proximate composition of the leaves, also shown in Table 1, was derived from the values determined at 7, 8, 9, and 10 weeks. Between the two cultivars, there were no significant differences in their content of water, dry matter, crude fat, crude fiber, calcium, and phosphorus whereas Lrn/09 had lower total ash but slightly higher soluble carbohydrates and crude protein than Lrn/10. When these results are compared with those reported for the more commonly used leaf vegetables in Nigeria (Oke, 1966; Oyenuga, 1968; Taylor, 1988), bungu is not inferior as far as protein and mineral nutrients in the leaves are concerned.

Generally, the mean values indicate that the leaves contain low calories (soluble carbohydrates and fat) as well as high levels of protein (29.35 - 29.85%) and two of the elemental nutrients needed in large amounts by the human body, i.e. calcium (2.60 - 2.62%) and phosphorus (0.25 - 0.27%). The vegetable is, therefore, a potent supplement to the starchy staple foods with which it is traditionally consumed. Mohan and Janardhanan (1995) opined that the prohibitive cost of animal protein in developing countries (of which Nigeria is one) calls for extensive exploitation of plant protein sources, which are often economically cheaper. It is noteworthy that although the calcium content of bungu leaves is relatively high, its availability to the human body needs to be investigated. Oke (1966) observed that calcium bioavailability could be lower than expected due to its usual occurrence as insoluble oxalates and phytates.

Table 2 shows that the mature seeds of the two cultivars are similar in respect of percentage composition of crude protein, calcium, and phosphorus. Lrn/09 seeds had higher contents of dry matter, crude fat, and crude fiber while Lrn/10 seeds were superior in respect of water, soluble carbohydrates, and total ash contents. When compared with the proximate composition reported for some of the

conventional oil-yielding seeds, such as sesame, soyabean, cotton, and olive (Oyenuga, 1968; Nayar and Mehra, 1970), bungu seeds can be said to contain appreciable levels of oil (17.25 - 21.00%), crude protein (21.32 - 22.15%), crude fiber (25.75 - 29.75%), calcium (2.65 - 3.15%), and phosphorus (0.53 - 0.54%).

These results suggest that the seeds are potentially capable of being exploited as commercial source of vegetable oil and the extracted meal as vital source of protein and minerals for livestock feeds, subject to tests confirming the presence or absence of anti-nutritional factors in it. It may be concluded that the consumption of bungu leaves should be promoted, especially in families that can ill-afford the prohibitive cost of animal protein.

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