PROFESSIONAL PAPER

Proximate Analysis of Fresh and Dry Leaves of *Telfairia occidentalis* (Hook.f.) and *Talinum triangulare* (Jacq.) Willd

Elizabeth Oluwatoyin Orhuamen, *Olorunmaiye, Kehinde Stephen, Adeyemi, Christiana Oreoluwa

Department Plant Biology, University of Ilorin, Nigeria

Summary

A study of the proximate analysis of two commonly grown and consumed leafy vegetables in Nigeria "fluted pumpkin (Telfairia occidentalis) and water leaf (Talinum triangulare) was carried out. Leaves of the two vegetables were analysed in both wet and dry conditions with the aim of determining their nutrient contents and the effects of sun drying on these nutrients. The results revealed the presence of protein in the fresh leaves of Telfairia occidentalis and Talinum triangulare to be 8.31% and 2.99% respectively, while, their dried leaves protein contents were 3.43% and 2.45% for both Telfairia occidentalis and Talinum triangulare respectively. Fat content was higher in fresh leaves T.occidentalis than its dried leaves (1.40% and 0.70%), while, this was higher in the dried leaves than the fresh leaves of T. triangulare (of 0.65% and 1.45%) respectively. Crude fibre content was constant in both fresh and dried leaves of T. occidentalis (2.20 % each) but higher in the dried leaves of T. triangulare than its fresh leaves (4.0% and 1.20%) respectively. Ash contents were higher in the dried leaves than the fresh leaves of both Telfairia occidentalis (fresh leaves 1.5%, dried leaves 10.40%) and Talinum triangulare (fresh leaves 1.0%, dried leaves 8.85%). Talinum triangulare contained higher moisture in both its wet and dried leaves (22.6 and 13.40%) than that of Telfairia occidentalis (5.60 and 0.76%). Drying had effects on these vegetables as both recorded decrease in their moisture and crude protein contents on drying. Crude fibre, ash and Nitrogen free extract of both samples either increased or remained relatively constant.

Keywords: *Drying, Fresh, Leaves, Nutrients, Vegetables*

Introduction

Vegetables are the edible parts of plants other than the sweet fruits or seeds; this typically means the leaf stem or root of a plant. The role of vegetables cannot be overestimated as they play an important role in nutrition and health of human beings. Vegetables are indispensable constituents of human diet supplying the body with minerals, vitamins and certain hormones as well as precursors in addition to protein (Oyenuga and Fetuga, 1975). These vegetables supply the body with nutrients which are absorbed and used as energy sources, body building, regulatory and protective materials.

The consumption of vegetables in Nigeria had been on the increase and currently is estimated to be about 22-47.58 kg/person/year (Hart *et al.,* 2005). Several vegetable species abound in Nigeria and most West African countries where they are used partly as condiments or spices in human diets or as supplementary feeds to livestock such as rabbit, poultry, swine and cattle (Agbede *et. al.,* 2008, Aletor and Adeogun 1995). These leafy vegetables are generally comparatively rich in fibre while cereals, root vegetables and other food stuff are relatively poor sources (Brian and Allan 1982). Some of these leafy vegetables commonly consumed in Nigeria include *Telfairia occidentalis* (Ugu leaf), *Veronia amygdalina* (Bitter leaf), *Amaranthus sp*., *Cochorus olitorus* (Ewedu), *Talinum triangulare* (Water leaf) and a host of others. These vegetables are popular among the people because of the soft texture of their leaves and palatability.

Since time immemorial, *T. occidentalis* and *T. triangulare* have formed an integral parts of the meal of an average Nigerian. These vegetables find uses in soups, stews and porridges. Generally they are consumed as cooked complements to major carbohydrate staples such as cassava, guinea- corn, yam, rice and plantain.

Fluted pumpkin (*Telfairia occidentalis*) belongs to the family *Cucurbtitaceae.* It is a crop of commercial importance grown across the lowland humid tropics of West Africa with Nigeria, Ghana and Sierra Leone being the major producers (Nkang *et al.,* 2003). *Telfairia occidentalis* occurs mostly in cultivated forms in various parts of southern Nigeria. It does not occur wild but may be encountered as an escape from cultivation (Irvine, 1969). It is widely cultivated for its palatable leaves especially by the Igbo's among whom it is fast becoming an important vegetable. The plant is dioecious, perennial and drought tolerant. It is usually trellised; it thrives well in a well-drained soil, adequate water and sun. It is a climber of few metres; the flowers are white and dark purple. The sex of the fluted pumpkin is difficult to determine until after flowering which takes about four months after planting. The female leaves are preferred by the housewives and are therefore in higher demand (Ajibade *et al.,* 2006). The leaves constitute an important component in the diet of many people in West African countries (Gill 1988, Fagbemi *et al.,* 2005). Leaves of *Telfaria occidentalis* are rich in mineral elements (Akaowo, 2000). This green leafy vegetable is highly consumed and used in preparing different types of food like salads, soups and even the squeezed green leaves (green drink) is normally taken in folkloric medicine as a therapy for various forms of anaemia and malnutrition. Hence one can say *Telfairia. occidentalis* is a very important crop nutritionally, medicinally and economically.

Although *Talinum. triangulare* is of tropical African origin (Tindall, 1988; Mnzava, 1997), it is dispersed widely throughout the African subcontinent and south–eastern Nigeria in particular. It is commonly known as water leaf. It is a her-

Corresponding author: ksolorunmaiye@yahoo.com

baceous, perennial and glabrous plant widely known and used among the people of southern Nigeria (Abiose, 2003), tropical south America (Anderson, 1999; Boose and Holt, 1999), and in most African countries (Rabaihayo, 1994; Okafor *et al*., 1997). The stems and leaves are somewhat succulent with pink or purple flowers. It is a short duration crop which is due for harvest between 34-35 days after planting (Rice *et al.,* 1986). Water leaf is eaten as constituent of soups in Nigeria. Traditionally it is used to thicken soups and increased the bulk of stews (Daniel, 2004). In south East Asia, the roots are used as tonic for general weakness, possible substitute for ginseng, for the treatment of inflammation and swelling (ACB, 2004). Bearing in mind the numerous importance of these vegetables which have variously been reported in some journal articles for some other parts of the country, the aim of this study was to carry out proximate analysis of both *T. occidentalis* and *T. triangulare* grown in Ilorin, a north central city of the southern guinea savanna agro ecological zone of Nigeria.

Materials and methods

Sample collection

Fresh leaves of both *Telfairia occidentalis* and *Talinum triangulare* used in this study were purchased at a vegetable market of the University of Ilorin, Ilorin, Nigeria in April, 2011. The fresh leaves were washed in clean water and divided into two parts. One part was used as fresh sample for proximate analysis while, the other part was dried using the traditional method of sun drying in a tray for three days before proximate analysis was carried out.

Proximate analysis is based on the separation of food substances in to fractions in accordance with their nutritional values. The value fractions determined include; Water/moisture, Crude protein, crude fat, Ash, Crude fibre and Nitrogen free extract.

The proximate analysis was carried out according to the procedure of Association of Official Analytical Chemist (AOAC, 1990) to determine the moisture content, crude protein, crude fat, ash, crude fibre and nitrogen free extract of the fresh and dry samples. The proximate analysis of the samples was repeated three times.

Determination of percentage moisture content

Five grammes (5 g) of each sample was weighed into an aluminium foil W_1, weights of the foil and sample before oven drying W_2 were also noted and after drying W_3. Drying was done in the oven at 60ºC for 24 hours. The samples were then removed, cooled and weighed until a constant weight was achieved. Percentage moisture content was calculated as follows:

$$\frac{\text{Mass of moisture evaporated}}{\text{Mass of sample before drying}} \times 100$$

$$\frac{W_2 - W_3}{W_2 - W_1} \times 100$$

W_1 = mass of aluminium foil
W_2 = mass of aluminium foil + sample before drying,
W_3 = mass of aluminium foil and the sample after drying

Determination of percentage crude fat content

The method of AOAC (1990) was used, 2 g of each of the samples were weighed into a pre weighed filter paper (M_1) and then the weight of the filter paper and the sample was noted before extraction (M_2).The filter papers containing the samples were properly tied and then put into the Soxhlet extractor. The filter papers placed in the extraction chamber were suspended above an already weighed receiving flask containing petroleum ether (b.p. 40-60ºC) below the condenser. The flask was heated for 6 hours to extract the crude fat. The flask containing the crude fat was disconnected from the Soxhlet extractor and then oven dried at 100ºC for 24 hours. Afterwards, it was then cooled in a dessicator and weighed until constant weight was obtained (M_3). The difference in weight was expressed as percentage crude fat content.

Determination of percentage crude protein

The method of AOAC (1990) was used. Two gram (2 g) of each sample were weighed into a clean and dry kjedahl flask. 10g of anhydrous sodium tetraoxosulphate (VI) ($NaSO_4$) and 0.5g of Copper (II) tetraoxosulphate (VII) ($CuSO_4$) were added followed by 25ml of concentrated Tetraoxosulphate (VI) acid (H_2SO_4). The flask was heated by inclining it over a hot plate. The digestion was washed into a 250ml standard flask and made up to the mark with distilled water. Five millilitres (5 ml) of each of the digested samples were pippetted into the Buchi distillation unit and 5ml of NaOH solution was added. This was to make the solution alkaline and to enable ammonia (NH_3) to be liberated out of the solution. The ammonia liberated was distilled directly into a 5ml of Boric acid indicator in a 100ml conical flask containing about 45ml of distillate, which later turned green. The distillate contains ammonium borate. This solution was then titrated with 0.01ml HCl, which was the amount of acid needed to regenerate the blue colour of the Boric acid indicator and produce Ammonium Chloride. Titration continued until the green colour turned blue.

Determination of percentage ash content

The method of AOAC (1990) was used. Two gram (2g) of each sample were weighed into small dry crucibles of known weight. The samples in the crucibles were placed on a low flame and ashed in a furnace at red hot (60ºC) which was kept constant for 3 hours. The ashed samples were removed from the furnace, cooled and kept in a dessicator until constant weights were obtained.

Determination of percentage crude fibre content

The method of AOAC (1990) was used, the residue left after the extraction of the oil contents from the samples provided in the oil content determinations were used for this exercise. The fat- free materials were transferred into the spout less beakers and boiling water was added alongside 25ml of 10% sulphuric acid and they were made up to the 200ml level. The mixtures were boiled for 30 minutes and filtered by means of suction. The residues obtained were then washed with boiling water for at least three to four times and transferred back to the beaker. Boiling water was added followed by 25ml of 10% NaOH and made up to the 200ml level and it was then boiled

Table 1. *Proximate analysis of fresh and dried leaves of Telfairia occidentales and Talinum triangulare*

Vegetable	Sample	% Water content	% Crude Fat	% Crude Protein	% Ash	% Crude Fibre	% Nitrogen Free Extract
Telfairia occidentales	Fresh Leaf	5.6	1.4	8.31	1.5	2.2	80.99
	Dried Leaf	0.76	0.7	3.43	10.4	2.2	82.51
Talinum triangulare	Fresh Leaf	22.6	0.65	2.99	1	1.2	71.56
	Dried Leaf	13.4	1.45	2.45	8.85	4.0	69.85

again for 30 minutes and filtered by means of suction. The residues obtained in the oven were dried, weighed and noted. The residues were ashed to oxidize off the crude fibre and then the ashes obtained were weighed and noted. The amount of the crude fibre in the samples was calculated by subtracting the weight of the ash from the weight of the residue. The crude fibre content was then expressed as percent loss in weight on ignition.

Determination of percentage nitrogen free extract

The nitrogen free extract (NFE) is assumed to be the carbohydrate fraction of the sample. Percentage NFE was calculated as: 100- (% Moisture + % Crude Protein + % Crude Fibre + % Crude fat + % total ash).

Results and discussion

Percentage moisture content

Percentage water contents otherwise referred to as moisture content in both *T. occidentalis* and *T. triangulare* were substantially reduced after drying. Leaves of *T. triangulare* contain higher moisture content than those of *T.occidentalis* both in the fresh and dried forms (Table 1). From these results, it can be inferred that the moisture content of *T. triangulare* was relatively higher than that of *T. occidentalis*. This may be due to the fact that the leaves of *T. triangulare* are naturally more succulent than those of *T. occidentalis*. This observation is in close agreement with the reports of Saidu and Jideobi (2009) and Tindall (1988). However, *T. occidentalis* is likely to stay longer before use or processing due to its low moisture content since the low moisture content of the leaves coupled with drying could hinder growth of micro organisms, hence storage life would be longer (Awogbemi and Ogunleye, 2009). Drying reduced substantially the moisture contents of both vegetables. Drying can be of very good advantage for traditional preservation by the consumers of these leafy vegetables in Nigeria since there will be ease of preservation through sun drying for use when needed.

Percentage crude Fat

Percentage crude fat content was higher in the fresh leaves (1.4%) of *T. occidentalis* than its dried leaves (0.7%) and was also higher than that of the fresh leaves (0.65%) of *T. triangulare* (Table 1). However, the percentage crude fat obtained in the dried leaves (1.45%) of *T. triangulare* was higher than that of its own fresh leaves as well as in both fresh and dried leaves of *T. occidentalis* (Table 1). The amount of crude fat present in both vegetables seems to be moderate and may be adequate for consumption without any health threat. This observation agreed with the earlier report of Antia *et. al*., (2006) who noted that excess fat consumption was implicated in certain cardiovascular disorders such as atherosclerosis, cancer and aging. Low crude fat contents in these two vegetables also agreed with the earlier report of Aja *et. al.,* (2010) who observed low fat content in *T. triangulare,* also with the report of Akwaowo *et. al.,* (2000) who observed increase in the fat contents of the leaves of *T. occidentalis* with increase in the age of leaves.

Percentage crude protein

Percentage crude protein was higher in the fresh leaves of *T. occidentalis* than its dried leaves 8.31 and 3.43% respectively (Table 1). In *T. triangulare*, % crude protein was a bit higher in its fresh leaves than dried ones 2.99 and 2.45% respectively (Table 1). Comparing the crude protein contents of the two vegetables, leaves of *T. occidentalis* contained more, both in its fresh and dried leaves (Table 1). Percentage crude protein was high in both fresh and dried leaves of *T. occidentalis* as well as in *T. triangulare*, thus suggesting that consumption of these vegetables may provide good dietary protein. This observation was different from the reports of Aja *et.al.* ,(2010), Omale and Ugwu, (2011), who observed higher crude protein contents in the dried leaves of *T. triangulare* than its fresh leaves and lower crude protein contents in both *T. occidentalis* and *T. triangulare* respectively.

Percentage Ash

The percentage ash content was much lower in the fresh leaves of *T. occidentalis* than its dried leaves 1.50 and 10.40% respectively (Table 1). The same trend was noticed in *T. triangulare* where fresh leaves contain much less % ash than its dried leaves 1.00 and 8.85% respectively (Table 1). Comparatively, *T. occidentalis* contains higher % ash both in its fresh and dried leaves than in *T. triangulare* (Table 1). High ash contents were also reported in these two vegetables by Omale and Ugwu, (2011).

Percentage crude fibre

There was no apparent difference in the contents of % crude fibre of fresh and dried leaves of *T. occidentalis* 2.20 and 2.20% respectively (Table1). *Talinum triangulare* , however, had higher percentage crude fibre in its dried leaves than in its fresh leaves 4.00 and 1.20 % respectively (Table 1). Crude fibre was greater in the dried leaves of *T. triangulare* than what was obtained variously in both fresh and dried leaves of *T. occidentalis* 4.00, 2.20 and 2.20% respectively (Table 1).

Nitrogen free extract

T. occidentalis was higher in Nitrogen free extract (NFE) both in its fresh and dried leaves and much higher than what was obtained in *T. triangulare* (Table 1). Dried leaves of *T. occidentalis* contain higher NFE than its fresh leaves 82.51 and 80.99% respectively (Table1). While in *T. triangulare* dried leaves contained 69.85 and fresh leaves contained 71.56% respectively.

Conclusion

The quantitative data obtained from proximate analysis of fresh and dried leaves of *T. occidentalis* and *T. triangulare* contain appreciable amount of nutrients to supplement our dietary need for good health. Since both vegetables can readily be sundried, they can be available for consumption all year round. High amount of moisture content found in *T. triangulare* is very important as this moisture plays an important role in almost all body functions and thus should be eaten often. The two vegetables could be eaten together, as the high moisture and fibre present in them can be of importance since fibre could aid quick bowel movement and digestion. As a result of drying the percentage proteins of both vegetables decreased, therefore it is advised that they are consumed fresh.

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