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**PRODUCTION, MARKETING, NUTRITIONAL VALUE AND USES OF FLUTED PUMPKIN (*Telfairia occidentalis* Hook. F.) IN AFRICA**

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**Janet O. Alegbejo**

Department of Paediatrics

Ahmadu Bello University Teaching Hospital, Shika, Zaria, Nigeria

**ABSTRACT**

Fluted pumpkin (*Telfairia occidentalis* Hook. F., Family: Cucurbitaceae) have two main varieties in Nigeria: Ugu-ala and Ugu-elu which are widely cultivated in the West and Central Africa. It is called 'ugu' by the Igbos, 'ugwu' by the Yorubas and 'ekobon' by the Cameroonians. Fluted pumpkin grows best in warm humid tropics therefore it is a rain fed crop but can be grown under irrigation. During the rainy season, staking is commonly practiced to reduce disease infection but in dry season there may be no need since diseases are less. The leaves are wrapped in bundles with plantain leaves or loosely covered with old jute sacks and sparingly sprinkled with water for freshness. When it is not possible to bring fresh leaves to the market, the leaves may be blanched and then dried. The dry leaves are in demand during the dry season when fresh leaves are scarce. Fruits are harvested and stored in an open shade for 1- 2.5 months. The nutritional value, its uses and health benefits are discussed.

**INTRODUCTION**

Fluted pumpkin (*Telfairia occidentalis* Hook. F., Family: Cucurbitaceae) probably originated from the south eastern Nigeria, and is widely distributed among the Igbo speaking people, particularly around Imo state, Nigeria (Esiaba, 1982; Burkill, 1985; Akoroda, 1990a), where it has the widest diversity (variation in pod and seed colour, seed and plant vigour, anthocyanin content of leaves and petioles or shoots, leaf size and their succulence, dioecious or monoecious plants) (Chewya and Eyzaguirre, 1999; Chinhande *et al.*, 1997). Leaves are spirally arranged, with 3-5.5 cm long while female flowers are solitary in leaf axils; they are 5-merous and cream coloured; fruit is drooping, ellipsoid berry 40- 95 cm by 20-50 and weighs about 10 kg; seeds are compressed ovoid about 4.5 cm long, black or brown – red (Grubben and Denton, 2004; Pursglove, 1991). It is a herb climbing by coiled, often branched tendrils to a height of over 20 M. The root system ramify the top surface of the soil, stem is angular glabrous and fibrous when old. There are two main varieties in Nigeria: Ugu-ala (succulent, broad leaves, small black seeds about 12 g, a thick vine and slow growth); Ugu-elu (high growth rate, large brown coloured seeds of 20 g or more, fast emergence, thin stems and small leaves) (Omidiji, 1997; Chewya and Eyzaguirre, 1999; Odiaka, 2001). A third cultivar, Nsukka local was selected from local land races and is tolerant to root knot nematodes. It is widely cultivated in the West and Central Africa (Benin Republic, Cameroon, Nigeria, Sierra Leone to Angola, and up to Uganda in east Africa). It is called 'ugu' by the Igbos, 'ugwu' by the Yorubas and 'ekobon' by the Cameroonians (FAO, 1988; Schippers, 2002; Grubben and Denton, 2004). It has a close relative, *Telfairia pedata* (Sims) Hook which used to be cultivated in Ethiopia, Kenya, Madagascar, Malawi,

Mozambique, Rwanda, Tanzania, Uganda, and Zanzibar (Chihande, *et al.*, 1997; Schippers, 2002).

### **Ecology, Growth and Development**

Fluted pumpkin grows best in warm humid tropics. It is a rain fed crop but can be grown under irrigation (2-3 irrigations per week). It is a perennial but can be grown as an annual under limited rainfalls. Seed size affects vigour and seedling germination (Grubben and Denton, 2004). Viability is about 63-89% and germination takes 7-14 days. Large seeds show good growth potential (number of leaves, branches and uniformity of seedlings). Fruit growth is sigmoid over 8 weeks, but is rapid between 1.5- 5.5 weeks. Physiologically mature fruits are obtained 9 weeks after fruit set.

### **Production and Management**

During the rainy season, staking is commonly practiced to reduce disease infection. Plants are staked individually or, for fruit production. During the dry season staking is not needed for crops and for leaf production because there is less disease attack. Staking does not have a significant effect on the yield of leaves. Because of the prolific nature of the plant, weeds are not troublesome. Planting on flat land is the best method of weed suppression. About three weeding may be required in a staked crop during the rainy season. During the dry season when plants are not staked, two weedings are needed before the leaf canopy suppresses most weeds. Mulching can be used as a method of weed control and to retain soil moisture. The first pruning is 4 weeks after emergence to stimulate branching and increase the growth. Irrigation is necessary for high leaf or fruit production especially under sole cropping in the dry season. Watering is done once every 3 days. Organic manure or inorganic fertilizers are used in traditional systems, but for an optimal leaf yield the recommended fertilizer application is 100 kg K<sub>2</sub>O and 50 kg P<sub>2</sub>O<sub>5</sub> per ha. In southern Nigeria application of P was found to be especially important, as N and K only increased yields in combination with application of P. Female plants are more vigorous than male ones and produce higher vegetative yields. (Grubben and Denton, 2004).

### **Harvesting**

Harvesting begins about one month after emergence and is continued at 2-4 week intervals when new shoots are formed (depending on the cultivar, management practice, and environmental conditions) (Asiegbu, 1983). Harvesting is done by pruning with sharp knives just beneath the lowest acceptable leaf. Harvest interval has no effect on the life span of the crop, as this depends on level of irrigation. Commercial production in Nigeria is from November to July, with 20 or more harvests. Fruits (pods) are harvested 9 weeks after fruit set (Adetunji, 1997). Generally, female plants give higher yield than males ones (their leaves are larger, and vines are stronger, also they keep growing when flowers appear, which is not the case for males). If planting is specifically for young shoots and leaves, early removal of young flower buds is advantageous (Akoroda *et al.*, 1989; Akoroda and Adejoro, 1990; Akoroda, 1990b). Fresh shoot yield could be as low as 500-1,000 kg/ha, but with good management, it could be as high as 3-10 t/ha (good irrigation, adequate fertilization). Seed

yield could be up to 1.9 t/ha obtained from 3,000 fruits. The productive span is about 6-8 months. The plants will sprout again when rains set in (Schippers, 2002).

### Processing and Preservation

The harvested succulent leaves can only remain fresh for one day. Leaves are harvested and packed in jute bags. This may be stored in jute bags for up to 3 days in a well-ventilated condition. Larger bundles are wrapped with plantain leaves or loosely covered with old jute sacks and sparingly sprinkled with water for freshness (Asiegbu, 1983; Grubben and Denton, 2004). When it is not possible to bring fresh leaves to the market, due to oversupply or because the farm is too far, the leaves may be blanched and then dried. The dry leaves are in demand during the dry season (October to January) when fresh leaves are scarce (Badifu, 1993). Fruits are harvested and stored in an open shade for 1- 2.5 months. The fruits are graded before being sold. Seeds are left in the fruits until they are used for planting or consumed. Most of the fruits are transported by rail from the eastern to the middle belt and northern part of Nigeria. Collection and presentation of different fluted pumpkin accessions is being done in West and Central African Countries. Some level of varietal selection is taking place in Nigeria and Cameroon (Odiaka, 2001; Grubben and Denton, 2004).

### Marketing

Fresh succulent leaves are preferred by consumers; hence traders transport their product over long distances prefer smaller and less succulent leaves that are less perishable. The shoots are sorted out into lengths and tied into bundles. Care is taken to avoid breaking the stems. Large bundles are offered for whole sale, while the smaller bundles are sold as retail. The shoots are stored under the shade and water is sprinkled on it at intervals to keep it fresh. Watering is done minimally to avoid rotting of the leaves. The leaves are also transported by road from the south to the big cities in the northern Nigeria. Fruits are sold as mature or immature stage (about USS1.0-1.5) (Grubben and Denton, 2004). They are the source of seed for planting. The immature fruit is sold for its unripe seed that is appreciated as food. Fruits are found in all major markets in Nigeria and Cameroon during the dry season (Odiaka, 2001). Most Of the fruits are transported to the middle-belt or far north of Nigeria.

### NUTRITIONAL VALUE

*Telfairia* seeds and leaves have lots of nutritive value (Tables 1 and 2). These make the leaves potentially useful as food supplements (Oderinde *et al.*, 1990). The moisture content of the leaves show large variations and is a function of the cultivar plant age, environmental factors, and management practice.

Table 1. Nutritive value of *Telfairia* seeds and leaves

	<b>Seed</b>	<b>Leaves</b>
Water (ml)	6.0	86.0
Calories	543.0	47.0
Protein (g)	20.5	2.9
Fat (g)	45.0	1.8

Carbohydrates (g)	23.0	7.0
Fibre (g)	2.2	1.7
Calcium (mg)	84.0	0.0
Phosphorus (mg)	572.0	0.0

**Source:** FAO (1988)

Table 2. Trace elements in *Telfairia* seed flour: mg/100 g wet sample

<b>Potassium (k)</b>	<b>1824</b>
<b>Magnesium (M)</b>	<b>535</b>
<b>Sodium (Na)</b>	<b>280</b>

**Source:** Akintayo (1997)

The young leaves contain the anti-nutrients cyanide at 60 mg/100 g dry matter and tannins at 41 mg/100 g dry matter. The leaves contain adequate vitamins A and C. Mineral content of the seed is fairly high. The seeds are high in essential amino acids (except lysine) and are comparable with that of soybean meal with 95% biological value. The fruit pulp is about 1.0% protein and the seed oil is made up of oleic acid (37%), stearic and palmitic acid (21% each), linoleic acid (15%).

## Uses

The leaves and seeds are used as vegetables. The tender leaves, succulent leaves and immature seeds are cooked and consumed as vegetable. Leaves may be used alone or together with okra, dika nut (*Irvingia* sp.) or egusi seeds (*Citrullus lanatus* (Thunb.) Matsum. & Nakau. Sometimes they are mixed with 'eru' (*Gnetum africanum* Welw.) and *Pterocarpus soyauxii* Taub. They may also be cooked with fish, meat and tapioca, and are then eaten with pounded yam, 'eba', 'apu' and 'amala' etc. These are favourites throughout Central and Southern Nigeria (Grubben and Denton, 2004; Schippers, 2002). Sometimes male flowers are picked for consumption together with the shoots and leaves. When the leaves are becoming coarse, they are often mixed with other vegetables such as waterleaf (*Talinum fruticosum*). The immature seeds are shelled and the kernels are eaten boiled or roasted and used as snack. To ease seed shelling, the seeds are boiled for about 30-60 minutes. This is then added to the soup in ground form (Schippers, 2002). Mature seeds are first washed to remove the dye found in the cotyledon. They are less tasty, but are good sources of edible oil. Ground seeds are used in making cakes which are high in protein and are suitable for fortifying foods, while the oil is served as cooking oil and for making margarine. The oil can also be used as drying oil for paints and varnishes (Grubben and Denton, 2004). Pregnant women and patients suffering from anemia use the leaf juice to strengthen the blood. Other uses include: stems are macerated to produce fibres that are used as sponge; the oily seeds have lactating properties and are therefore in high demand by women with young babies; the raw flour shows better water- and fat adsorption properties than the oil, hence it is useful in baking and ground meat products; the rind and pulp of the fruit is used as fodder for livestock.

### Health Benefits of Fluted Pumpkin

The sliced young leaves mixed with coconut water and salt could be stored in a bottle and used for the treatment of convulsion (Gbile, 1986). Also the leaf extract alone is useful in the management of hypercholesterolaemia, liver problems, and impaired immune system (Eseyin *et al.*, 2005a; Adaramoye, 2007) but the oil from the seed could result in hyperlipidemia and hyperglycaemia if consumed excessively. Protein Energy Malnutrition (PEM) is rarely seen among the dwellers where *Telfairia* is consumed in large proportion daily (Dike, 2010). The use of *T. occidentalis* in reproductive and fertility is gaining ground. Nwangwa *et al.* (2007) showed that it has potential to regenerate testicular damage and increase spermatogenesis. *Telfairia* is high in anti-oxidant and free radical scavenger properties and that may contribute to why many use the leaf extract in oxidative damage condition such as cancers, liver and liver diseases. In Nigeria the fresh leaves are ground and the juice used as tonic by women that have just given birth; its high iron content assists in the replenishment of lost blood; being used for treatment of anaemia, chronic fatigue and diabetes (Alada, 2010; Dina *et al.*, 2006; Aderibigbe *et al.*, 1999). The blood schizontocidal activity of the root of *Telfairia* is comparable to that of chloroquine (Okokon *et al.*, 2007). The extract also shows inhibitory effect on growth of some bacteria (Oboh *et al.*, 2006; Odoemena and Onyeneke 1998; Oluwole *et al.*, 2003). *Telfairia* roots are very poisonous because of their high saponin content and are used to kill rats and mice as rodenticide and ordeal poison (Gill, 1992).

### Future Research Needs

Collection and identification of the various cultivars in the African continent is very essential; statistical data on total production in each country is inevitable; more information is needed on the uses of the crop in the traditional African societies, more study on the nutritive value of the leaves and seeds of different fluted pumpkin cultivars will be very useful; more research into the health benefits of the various parts of the crop is urgently needed especially the study of phytochemicals in fluted pumpkin (from the seedling to their consumption, passing through the harvesting, storage and processing etc) to have a better understanding of their mechanisms in human health.; breeding work on the crop is at its rudimentary stage and needs upgraded; improved planting materials are needed to increase its production. Collaborative research work between the Research Institutes and scientists working on the crop should be set up.

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