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Physico-Chemical Composition of Leaves, Meals and Oils of Fluted Pumpkin (*Telfairia occidentalis*) and Melon (*Citrillus vulgaris)*

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Abstract: Proximate composition of leaves, meals and oils of fluted pumpkin and melon were determined by AOAC methods of analysis (1984). Both meals were found to be richer in protein, fat, carbohydrate and mineral elements than leaves. Melon meal was however, higher in protein and fat; but lower in moisture, carbohydrate, fibre and ash contents than fluted pumpkin meal. Both leaves are found to be good source of vitamin C (100 – 105mg/100g).The quality of both oils were almost the same except in free fatty acid, para-anisidin and acid values. Mineral elements composition were determined by Atomic Absorption Spectrophotometer (AAS), except Na, and K (Flame photometer was used). Both leaves and meals have very low level of trace metals.

Key words: Composition, leaves, meals, oils, fluted pumpkin, melon

INTRODUCTION

Melon and fluted pumpkin (*cucurbitaceae* family member) have received a considerable attention in past years. This is due to their nutritional and health protective values of the proteins from the seeds. Fluted pumpkin seed flours are now being used as protein supplements in a variety of local foods [1,2] In recent time, preliminary investigations in laboratories showed that germinanting pumpkin seeds reduced blood glucose levels of alloxan-diabetic rats but fresh pumpkin seeds did not do such[3,4] and in vitro protein digestibility of bread was detected to improve when pumpkin seed proteins were added[5]. The melon seed (*citrullus vulgaris*) can be milled and used to prepare a popular "egusi" soup where it acts as food thickener. It can also be fermented to produce "ogiri" and used as condiments to season or flavour soup[6].Fluted pumpkin seeds can be ground and used to make sauces. The seeds are sold in the shell raw. They can be found in health food stores and some supermarkets.

Attention has not been focused on the under-utilization of agricultural food products. This work therefore, assessed the nutritional values of leaves, meal and oil of fluted pumpkin and melon; for maximum utilisation of available resources and it results in the production of various products for food or animal feeds.

MATERIALS AND METHODS

Collection of Sample: Fluted pumpkin and melon seeds and their leaves were plucked from a farm in Asero area of Abeokuta, Nigeria. The leaves and meals were prepared be sun-drying of the seeds (30±2^{0}C) to about 10% moisture contents, dehulling and milling to pass through a 40-mesh sieve. The leave and meals flour samples were packed in polythene bags separately and stored in dark cupboard. The oils were extracted with the aid of soxhlet extractor. The oil samples were poured into amber colour bottle and kept in dark cupboard.

Chemical Analysis: The proximate composition was carried out using the methods of the Association of Official Analytical Chemists[7]. While nitrogen was determined by the microkjeldahl method described by Pearson[8] and the percentage nitrogen was converted to crude protein by multiplying by 5.70.The minerals were analyzed from solutions obtained by first dry-ashing the sample at 450^o C and dissolving the ash in 0.1MHCl and transferring to 100 mL standard flask using distilled de-ionized water to make it up. Metallic composition of the sample leaves and meals were determined using Flame photometer for Na and K; a Perkin Elimer 503 Atomic Absorption Spectrometry (AAS) for other metals. Free fatty acid, peroxide, anisidine acid, iodine and saponification values were determined by Paraquot method[9].

RESULTS AND DISCUSSION

The proximate compositions of fluted pumpkin and melon leaves were given in Table 1. The moisture contents of the fluted pumpkin and melon leaves were found to be 86.0 and 87.30%, respectively. These values were higher than that of bitter-leaf (21.6%) and *Cochrus olitorius* (ewedu) 23.7% but lower than that of water leaf

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Table 1: The proximate composition of fluted pumpkin and melon fresh leaves

Parameters	Fluted pumpkin leaf (%)	Melon leaf (%)
Moisture	86.0±8.95	87.3±9.23
Protein	4.3 ± 0.62	3.5 ± 0.82
Total fat	0.8 ± 0.01	1.2 ± 0.32
Total carbohydrate	-	-
Crude fibre	2.3 ± 0.38	2.8 ± 0.55
Vitamin C (mg/100g)	105 ± 2.33	100 ± 1.86
Ash	6.0 ± 0.96	2.9 ± 0.81

Means of three readings ± SD

90.8% Oguntona[10] and Indian spinach 93.4% Aletor[11]. Fluted pumpkin leaf protein contents is close to that of *Amaratus hybridus* (4.6%), *Solanum macrocarps* (4.6%), *Solanum nigrum* (4.3%) and *Ceratotheca seamoides* (4.5%) Oguntona[10]. While melon leaf's protein was found to be as much as what was reported for *Crassocephalum spp* (3.2 – 3.4%), and even more than common vegetables such as water leaves (*Talinum triangulare*) - 2.4%, Indian spinach (*Basella alba*) – 1.6% and sorrel leaves (*Hibiscus sabdarrifa*) - 1.9% Oguntona[10].

The total fat content of the pumpkin and melon leaves (0.85 and 1.2%, respectively) were found to be lower than *Cochrus olitorius* leaves - 55.4%, but higher than that of water leaf - 0.4% Oguntona[10], and Indian spinach leaves (*Basella rubra*) - 0.3% Aletor[11].

Similarly, the crude fibre content of the fluted pumpkin (2.3%) and melon (2.8%) leaves were higher than Indian spinach leaves - 0.6% Aletor[11] and water leaf - 1.0% Oguntona[10] but lower than the values reported for bitter leaf (*Vernonia amygdalina*) - 10.9% and *Cochrus olitorius* leaves 8.5% Oguntona[10]. This may be due to the different locations of both leaves and characteristics of the plants.

The Ash content of the fluted pumpkin leaf is higher than that of melon leaf, which indicates the higher metallic composition of fluted pumpkin over melon leaves (Table 1). At the same time, both green leaves vegetables studied are in the same range in ash content with other common vegetables as observed by Oguntona[10]. The amounts of vitamin C in leaves studied are 105 and 100mg/100g for Fluted pumpkin and melon. These values are within the amount reported for grape leaves (100mg/100g) by Sat *et al.*[12]. Therefore, both fluted pumpkin and melon leaves can said to be good source of vitamin C as suggested for grape leaves.

The metallic composition of fluted pumpkin and melon leaves given in Table 2 compared well with each other. The Calcium content of the two leaves were given as 2.1% in melon and 1.71% in fluted pumpkin, which are lower than water leaf – 2.40% Ifon[13] and Indian spinach - 2.3% Aletor[11], but more than bitter leaf – 1.08% Oguntona[10] and *Cochrus olitorius* -1.26% Ifon[13]. Fluted pumpkin and melon leaves are low in sodium, but relatively high in potassium (Table 2). Consumptions of these leaves may assist the reduction of blood pressure due to their high in potassium[14]. This observation is in agreement with the common vegetables studied by Latunde – Dada[15]. The level of trace metals such as lead, cadmium and nickel i.e.0.001, 0.005-0.008 and 0.02-0.013 respectively pose no threat to the consumption of the leaves vegetable studied. Pumpkin has been known to be one of the sources of Iron[11] due to higher concentration of Iron (0.12%). It can be suggested that melon leaves can also be used in this regard, since both leaves contain almost the same level of Iron (Table 2).

Table 2: The mineral element composition of fluted pumpkin and melon fresh leaves

Metals	Melon (%)	Pumpkin (%)
Calcium	2.1 ± 0.12	1.71 ± 0.59
Phosphorus	0.05 ± 0.01	0.05 ± 0.01
Potassium	3.5 ± 0.38	3.5 ± 0.92
Sodium	0.8 ± 0.07	0.8 ± 0.28
Iron	0.12 ± 0.01	0.12 ± 0.009
Magnesium	0.08 ± 0.01	0.08 ± 0.01
Zinc	0.003 ± 0.001	0.01 ± 0.00
Lead	0.001 ± 0.000	0.001 ± 0.00
Cadmium	0.005 ± 0.001	0.008 ± 0.001
Copper	0.004 ± 0.001	0.03 ± 0.008
Nickel	0.02 ± 0.009	0.013 ± 0.005

Means of three readings ± SD

The fluted pumpkin and melon seed meal have moisture content 12.8% and 5.9% respectively (Table 3). These values are lower when compared to *Mucuna urens* of 89.8% Achinewu[6], but higher than 4.5% of jackbean[16] and 4.1% of Benni seeds[17].

The protein content of melon seed meal of 32.1% is higher than 20.1% of fluted pumpkin seed meal (Table 3). These values are in agreement with the finding of Ige *et al.*[18] for melon seed meal and Nwokolo and Sim[19] for fluted pumpkin seed meal. Both seed meals studied are not only rich in protein but also in fat (Table 3). Melon oil is commercially available but that of pumpkin is yet to be utilized. At the same time fluted pumpkin seed meal can also be used as one of the sources of protein for animals and man. However, fluted pumpkin and melon meals protein are higher than jackbean 11.3% Ene-Obong[16], *Mucuna urens* 18.2% Achinewu[6] and Benni seed 17.2% Dashak[17].

The fibre content of melon and fluted pumpkin seed meal, were found to be lower (4.5 and 6.2% respectively) than that of *Mucuna urens* – 51.1% Achinewu[6] and benni seed – 18.6% Dashak[17] but higher than 1.9% of Jackbean[16] and 5.09% of pigeon pea[20]. Fluted pumpkin seed meal contains 10.5% carbohydrate while melon seed contain 3.1% (Table 3). The low carbohydrate value of the melon seed meal (3.1%) is probably due to its high fat and protein contents.

Table 3: The proximate composition of fluted pumpkin and melon meals

Parameter	Fluted pumpkin meal (%)	Melon meal (%)
Moisture	12.8 ± 2.11	5.9 ± 1.09
Protein	20.1 ± 4.72	32.1 ± 3.18
Total fat	34.2 ± 4.93	52.2 ± 4.51
Total carbohydrate	10.5 ± 2.05	3.1 ± 0.96
Crude fibre	6.2 ± 2.62	4.5 ± 2.37
Ash	3.8 ± 0.52	1.1 ± 0.02

Means of three readings ± SD

Table 4: The mineral element composition of fluted pumpkin and melon meals

Metals	Melon (%)	Pumpkin (%)
Calcium	58.02 ± 6.13	73.02 ± 6.90
Phosphorus	50.73 ± 4.84	65.14 ± 5.18
Potassium	40.84 ± 5.92	38.99 ± 2.87
Sodium	1.73 ± 0.62	2.10 ± 0.05
Iron	48.51 ± 3.25	54.83 ± 4.64
Magnesium	54.85 ± 4.11	52.18 ± 3.28
Zinc	59.95 ± 3.56	58.15 ± 2.61
Lead	0.004 ± 0.001	0.005 ± 0.001
Cadmium	0.01 ± 0.005	0.03 ± 0.002
Copper	55.00 ± 4.28	63.11 ± 4.16
Nickel	0.1 ± 0.06	0.04 ± 0.01

Means of three readings ± SD

Table 5: The Physico-chemical properties of fluted pumpkin and melon seed oils

Parameters	Pumpkin Oil	Melon seed oil
Refractive index (30^0C)	1.4717±0.05	1.4730±0.04
Specific gravity (60^0C)	0.9280±0.03	0.9235±0.02
Acid value (mg KOH/g of oil)	1.2±0.11	2.34±0.12
Free fatty acid (%)	0.93±0.06	2.15±0.07
Saponification number (mg KOH/g of oil)	212.6±4.76	208.1±7.98
Iodine value (mg of I/g of oil)	114.0±3.65	114.5±4.67
Unsaponification matter (%)	0.65±0.08	0.75±0.05
Peroxide value (0_2/kg of oil)	0.7744±0.20	0.455±0.26
Para-anisidine value	0.601±0.07	0.25±0.09

Means of three readings ± SD

The higher content of ash in fluted pumpkin meal (3.8%) than in melon meal (1.10%), indicates that the fluted pumpkin seed meal has higher mineral content than melon seed meal[20].

The metallic composition of fluted pumpkin and melon meal is given in Table 4. Our study showed that melon meal and fluted pumpkin seeds can supply reasonably larger amount of calcium. The calcium content of both seeds were found to be higher than that of Benni seed - 0.9% Dashak[17], *Mucuna urens* - 0.0265% Achinewu[6] and Cocoa bean - 0.00217% Olaofe *et al.*[21] The potassium content of fluted pumpkin and melon meal were higher than that of Cocoa bean - 0.03% Olaofe *et al.*[21] and Benni seed - 2.9% Dashak[17]. Since Iron, Zinc and Copper are micro-nutrients which is required in small quantity, table 4 shows that each of them will supply about 50% of Iron, Zinc and Copper and their values were found to be higher than Benni seed (Zn - 0.04%, Fe - 0.05%, Cu - 0.02%) (Dashak and Fali, 1993), Cocoa bean (Zn - 0.0064%, Fe - 0.00194%, Cu - 0.0087% (Olaofe *et. al.,* 1987) and *Mucuna urens* (Zn 0.0033%, Fe 0.0142%) Achinewu[6]. The phosphorus and the magnesium content of fluted pumpkin and melon meals were higher than that of Benni seed (Mg - 0.3%, P - 0.4%) Dashak[17] and *Mucuna urens* (P - 0.271%) Achinewu[6] and Cocoa bean (Mg - 0.33%) Olaofe *et al.*[21].

The lead, cadmium and nickel contents of both fluted pumpkin and melon meals were very minute which indicates a lesser toxicity of the meals studied.

The chemical and physical properties of the crude oils are presented in Table 5. The specific gravity values compared well with the 0.915 value reported by Kamel *et al.*[22] and Badifu[23] for melon. The oils had relatively high iodine values, thus reflecting a high degree of unsaturation. Saponification numbers were relatively higher than those reported in the literature for cottonseed oil (189-198) but were relatively lower than those for coconut oil (248-265) Codex[24]. The higher acid value and free fatty acids were found in melon seed oil. This indicates the high degree of lipolysis due to enzymatic activity. Virgin palm oil may contain as high as 100mg of KOH/g of oil[24]. Oils were low in unsaponifiable matter, and average values for refractive index and free fatty acids were comparable to those reported by Lazos[25].

The peroxide values of 0.7744 and 0.4555 meg peroxide/kg of samples obtained for pumpkin seed and melon seed oils respectively, indicated that the rate of rancidity and oil deterioration is very minimal, when the values are compared with 10 meg peroxide/kg of sample reported by the Codex Alimentrius Commission[24] for soya bean, cotton seed and coconut oils.

The para-anisidine value of 0.60 for pumpkin seed oil and 0.25 for melon seed oil can be compared with the 0.60 reported for groundnut oil[24]. This shows that there is reduction in the secondary oxidation process leading to the formation of hydroperoxide, which can be gradually broken down to carbonyl, the determinant of the level of the degree of rancidity and deterioration of the oil free fatty acid.

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