Proximate and Some Phytochemical Constituents of Three West African Vegetable Spices

Akinola Victor L[*1], Salami Adams A[1], Durodola Olamide I [1,*], Olasoju Abayomi S[2], Ogunsina Babatunde S[1].

[1]*Department of Agricultural and Environmental Engineering, Obafemi Awolowo University, Ile Ife, Nigeria*
[2]*Department of Agricultural Science Education, Adeniran Ogunsanya College of Education, Lagos, Nigeria.*

**Corresponding author: olamidedurdola@gmail.com*

ORCID: 0000-0002-6110-1011

Abstract

The proximate and some phytochemical composition of three African vegetable spices, namely celery, bay, and scent leaves, were investigated in this study. Fresh samples of the spices were obtained from a local market. They were cleaned, sorted, dried, and blended to reduce the particle size to flour. From the results of the analysis, the particle size of the scent, bay, and celery leaves flour ranged from coarse to fine size in that order, respectively. The water absorption capacity of celery leaf flour was greater among others, but bay leaf flour's oil absorption capability was the highest. The moisture content, fat, and crude fibre content of the spices flour ranged between 10.71 –10.84%, 1.81 – 4.5%, and 4.44 – 11.41%, respectively. While the ash, protein, and carbohydrate content were 2.18 – 8.69%, 0.92 – 14.88%, and 61.28 – 71.88%, respectively. The concentration of alkaloids, phenols, tannins, and saponins was higher in scent leaf flour when compared to others. However, flavonoids were more present in celery leaf flour. The large proportion of phytochemicals contents of the spices suggest that they are a good source of minerals. Generally, all the spices investigated are cheap, nutritionally rich, and have potentials for pharmacological applications.

Keywords vegetable spices, minerals, proximate analysis, properties, herbs

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INTRODUCTION

Food spices are part of the human diet, they are aromatic and pungent dried vegetable substances, which add colour, aroma, flavour, and tastes to foods (Gadekar and Yerramilli, 2006). Spices have vast applications such as food seasoning, food preservation, and medicinal uses. According to Altemimi *et al.* (2017), vegetable spices parts such as seeds, fruits, roots, flowers, leaves, and barks have been documented as valuable for several food, medicinal and industrial application.

Bay leaf (*Laurus nobilis*) is an herbal vegetable spices commonly used in cooking especially for their distinctive flavour and fragrance for the special aroma it gives in soups, stews, brines, meat, seafood, vegetable dishes, and sauces. The leaves also flavour many classic continental dishes; although often removed before serving especially because it can be abrasive on the digestive tract if eaten (WebMD, 2021). Its medicinal application as antedote for some stomach related problems have also been documented. Dried bay leaves have a fairly herbal and floral fragrance and the essential oil that makes it useful as an ingredient in perfumery. Scent leaf (*Ocimum gratissimum)*, is a perennial homegrown shrub and an aromatic herb that has been extensively used across tropical and subtropical regions of the world. It was reported by Pharmapproach (2021), that the leaves are mainly used as a spice for cooking delicacies due to its aromatic taste. The Scent leaf has been reported to be rich in plant chemicals and the crushed leaf juice is used in the treatment of convulsion, stomach pain and catarrh. Oil from the leaves has been shown to possess antiseptic, antibacterial, and antifungal activities (Ezekwesili et al, 2004). O. gratissimum has proved to be an effective anti-microbial (Orafidiya et al, 2001) and hypoglycemic and hepatoprotective agent *and also* in trado-medical practice, scent leaf is extensively used throughout West Africa as anti-malarial, mosquito repellent and anti-convulsant. Celery (*Apium graveolens*) is a biennial plant that occurs around the globe, it is a marshland plant in the family *Apiaceae* that has been cultivated as a vegetable since antiquity (Medhat, 2017).

Celery is an umbelliferous, aromatic, herbaceous plant grown for its leaves, seeds, oleoresin and essential oil. its plant is usually 30-60 cm high, erect with conspicuously jointed stems, bearing well-developed leaves on long expanded petioles (Elliot, 1999). The rigid fruit is small, ovoid, 1 to 1.5 mm long, 1 to 2 mm in diameter, contains a small brown seed. Celery has a long fibrous stalk tapering into leaves. Depending on location and cultivar, either its stalks, leaves or hypocotyl are eaten and used in cooking (Ballmer, 2000). The dried ripped fruits (celery fruit) are used as spice, Leaves and stalks are used as salads and in soups which makes the vegetable a popular low-calorie snack, Celery also provide a range of health benefits as the fiber in celery can benefit the digestive and cardiovascular systems, the leaf ontains antioxidants and used in preventing disease. Thekitchn (2021). In Nigeria, celery leaf is commonly known as Seleri (Yoruba, Ibo, and Hausa).

Some works have been carried out on the engineering properties of some African vegetable spices for food such as savory, caraway, dill (Desai *et al.*, 2013), thyme (Mustafa, and Cemalettin, 2014), curry (Kulathooran *et al.*, 2000), and cilantro (Rahman *et al.*, 2017). However, information regarding the proximate and some phytochemical constituents of these three spices namely, Bay (*Laurus nobilis)*, Celery (*Apium graveolens)*, and Scent leaves (*Ocimum gratissimum)*, are rarely obtained in the literature; hence in this work, proximate and some phytochemical constituents of three common vegetable spices found in Nigeria were investigated.

MATERIALS and METHOD

The materials obtained for the study include bay, scent, and celery leaves. They were obtained from a local market in Ile-Ife, Nigeria. It was cleaned and the initial moisture content of each of the samples was determined. Thereafter, it was sun-dried and blended to reduce the size of the material. The physiochemical properties and phytochemical contents of the spices (Figure 1) were determined in this study.

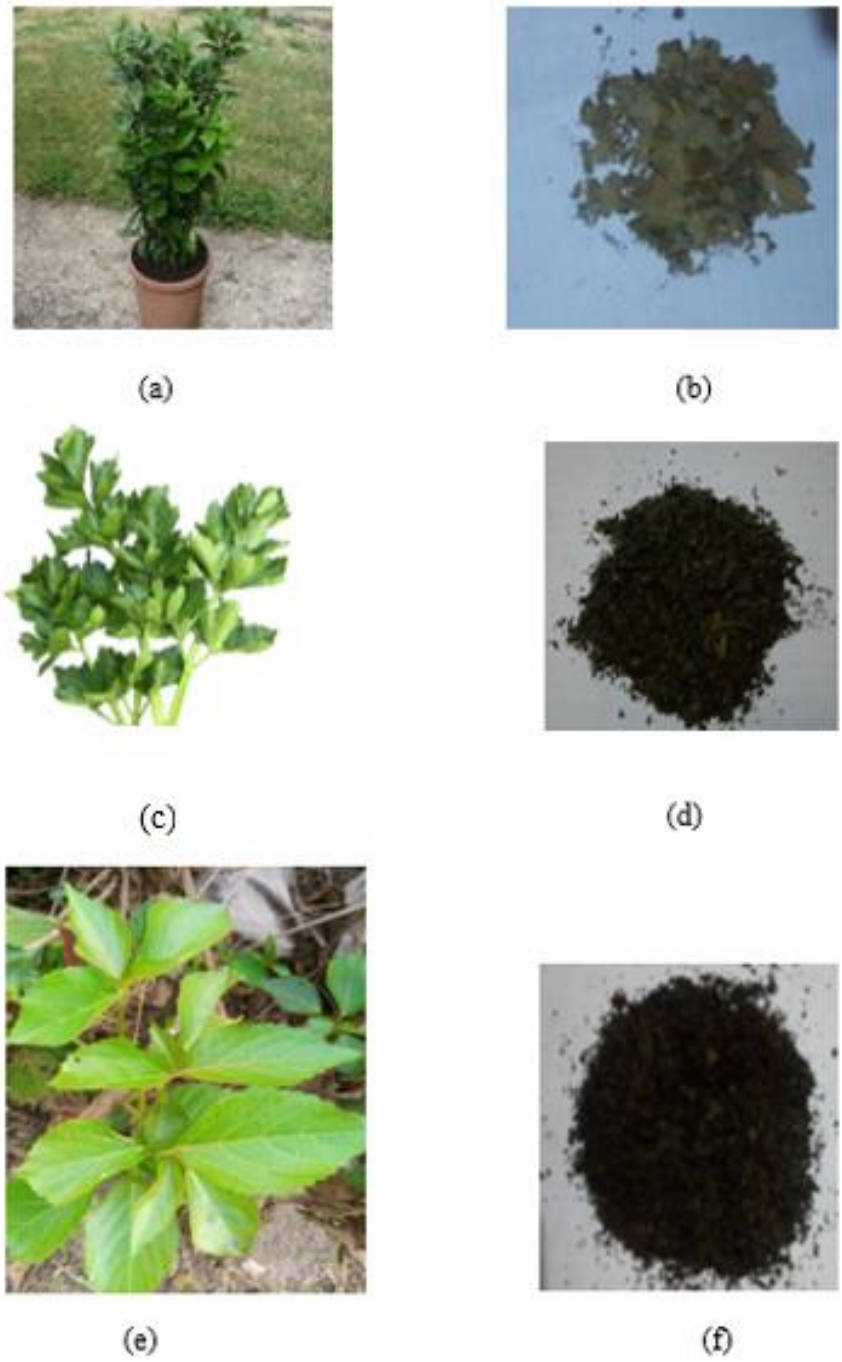

Figure 1. (a) Fresh bay leaf, (b) dried bay leaf (c) fresh celery leaf, (d) dried celery leaf, (e) fresh scent leaf, and (f) dried scent leaf

Particle size distribution analysis

The particle size analysis was carried out by weighing about 30 g of the flour samples and sieved with sieves of mesh sizes 850, 600, 425, and 300 µm using a mechanical shaker operated for 5 mins (Ogunsina *et al*., 2016).

The weight of the sample retained on each mesh was determined and the particle size distribution was calculated in percentages of the powder sample retained on each mesh. This procedure was replicated three times for each flour sample.

$$PSD = \frac{Wsr}{Wf} * 100\% \quad (1)$$

Where: PSD = Particle size distribution, W_{sr} = Weight of sample retained, W_f = Total weight of flour sample

Water and Oil Absorption Capacity

The water and oil absorption capacities were determined following standard procedure (Beuchat, 1977; Okunade *et al*., 2019). A Known weight (1 g) of each sample was mixed with 10 ml of distilled water (or refined groundnut oil for fat absorption capacities) in a 15 ml centrifuge tube. The mixture was centrifuged at 5000 g for 30 min at 27.5^0C, and the supernatant was quantified using a 10mL graduated cylinder. Water and oil absorption capacities were expressed as grams of water or oil bound per 100 g of flour from equation (2) and (3)

$$\text{Water Absorption Capacity} = \frac{Volume\ of\ Water\ Absorbed}{\text{Weight of sample used}} * 100\% \quad (2)$$

$$\text{Oil Absorption Capacity} = \frac{Volume\ of\ Oil\ Absorbed}{\text{Weight of sample used}} * 100\% \quad (3)$$

Proximate analysis

The protein content (Kjeldahl method), fat content (solvent extraction), ash content, crude fibre content was determined using the method described by AOAC (2005). While the carbohydrate content was determined following Olawoye and Gbadamosi (2020) approach. The mineral contents of the samples were determined in triplicates.

Determination of chemical composition

The chemical composition is the phytochemicals which include alkaloids, saponins, phenols, tannins, and flavonoids. The alkaloids content was determined following the methods of Okwu and Emenike (2006). The saponin content of the samples was determined following the method described by Okwu (2005). The tannin content was determined following Van-Burden and Robinson (1981) approach. The total phenolic content (TPC) and flavonoids of each sample were determined using modified Folin–Ciocalteu and aluminium chloride methods (Khodaie, *et al.*, 2012).

RESULTS and DISCUSSION

Proximate composition

Table 3 shows the result of the proximate analysis of bay, scent, and celery leaves. The Bay leaf has the highest fat, ash, and crude fibre content of 5.05%, 9.74%, and 12.79%, respectively. The carbohydrate content for each of the spices are of high values and are higher than each of the other contents.

Celery leaf has the highest carbohydrate content of the three spices with a value of 71.39%. Since ash content is a measure of the mineral content of the plant, it indicates that the bay leaf is a very good source of minerals. Crude fibre is an indication of the number of lipids in vegetable (Ejoh *et al*., 1996), The low crude fibre content in celery indicates its poor sources of lipids, while the high crude fibre in the bay and scent leaf makes them a good source of lipids.

However, excess consumption of fats in humans leads to cardiovascular diseases, ageing, and cancer (Kris-Etherton *et al*., 2002), the low concentration of lipid in celery makes it of more advantage to human health. Carbohydrate is a good source of energy which is essential for the maintenance of life in plant, animals, and human, celery indicating the highest carbohydrate content makes it a good source of energy.

The carbohydrate content of the studied vegetable spices is similar to those reported for alligator pepper, black pepper, clove, and ginger (Okunade *et al*., 2019). While the ash and crude fibre of the leaves are higher than those reported for garlic and African nutmeg (Onimawo *et al*., 2019).

Table 3. Proximate composition of scent leaf, bay leaf, and celery leaf flour

Property	Bay leaf	Celery leaf	Scent leaf
Fat (%)	5.05 ± 0.17^{b}	2.06 ± 0.11^{b}	2.14 ± 0.04^{b}
Fibre (%)	12.79 ± 0.35^{b}	5.04 ± 0.13^{b}	9.98 ± 0.02^{a}
Ash (%)	9.74 ± 0.26^{a}	6.21 ± 0.16^{a}	2.45 ± 0.04^{a}
Protein (%)	1.03 ± 0.03^{c}	5.04 ± 0.03^{c}	16.69 ± 0.01^{c}
Carbohydrate (%)	71.39 ± 0.17^{b}	81.64 ± 0.64^{a}	68.74 ± 0.51^{c}

Values are expressed as mean ± standard deviation of three replicates; Means having the same superscript in a row are not significantly different ($p<0.05$)

Phytochemical contents of scent leaf, bay leaf, and celery leaf

The result of the phytochemical analysis of the spices are shown in Table 4. The phytochemicals analysis of scent, bay, and celery leaf flour samples differed significantly. Scent leaf has significantly high alkaloids (12.17%), tannins (10.25 mg GAE/g), and saponins (9.65 mg/100g) contents when compared to bay leaf, which has alkaloids (2.45%), tannins (5.31 mg GAE/g), and saponins (4.47 mg/100g) and celery leaf, which has alkaloids (4.26%), tannins (6.88 mg GAE/g), and saponins (0.20 mg/100g). The vegetable spices studied have a wide range of pharmacological applications, which includes the production of quinine, ephedrine, galantamine, vincamimine, quinidie, morphine, and many others. This is because scent, bay, and celery leaves have a high percentage of alkaloids, flavonoids, tannins, and saponins, which are present in herbs. However, they are low in phenols. Many plants used in traditional medicines worldwide contain some certain level of the phytochemical contents, which can often account for their therapeutic action (Anupam *et al.*, 2018).

Table 4. Phytochemical composition (Quantitative) composition of Bay, Scent, and Celery flour

Property	Scent	Bay	Celery
Alkaloids (%)	12.17±0.15[a]	2.45±0.04[b]	4.26±0.07[b]
Flavonoids (mg GAE/g)	8.30±0.07[b]	5.72±0.20[c]	13.58±0.31[a]
Phenols (mg GAE/g)	1.08±0.05[a]	0.48±0.05[b]	0.32±0.06[b]
Tannins (mg GAE/100g)	10.25±0.15[a]	5.31±0.09[b]	6.88±0.06[b]
Saponins (mg/100g)	9.65±0.23[a]	4.47±0.23[b]	0.20±0.03[c]

Values are expressed as mean ± standard deviation of three replicates; Means having the same superscript in a row are not significantly different ($p<0.05$)

CONCLUSION

The particle size distribution, physical properties, and chemical composition of scent leaf, bay leaf, and celery leaf have been established in this study. The vegetable spices investigated are rich in carbohydrates, crude fibres, fats, and proteins, which form a large portion of the human diet. Scent leaf produced a coarse particle-sized flour while blended celery leaf has a fine particle flour. The low oil absorption capacity of celery leaf flour enhances its flavour retention capability, which made it a preferred flavouring agent. The large proportion of phytochemicals contents of the spices suggest that they are a good source of minerals. Generally, all the spices investigated are cheap, nutritionally rich, and have potentials for pharmacological applications.

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