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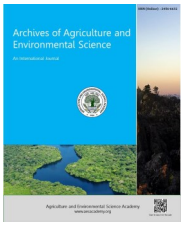

ORIGINAL RESEARCH ARTICLE

Nutrient characteristics assessment of two variants of okra (*Abelmoschus esculentus* L. Moench.) found in Anambra State, Nigeria

C.V. Ilodibia[1], U.A. Achebe[2] and C. Chiafor[1*]

[1]Department of Botany, Nnamdi Azikiwe University, P.M.B 5025, Awka, Anambra State, NIGERIA
[2]Department of Agricultural Education, Nwafor Orizu College of Education Nsugbe, Anambra State, NIGERIA
[*]Corresponding author's E-mail: chinyereokafor206@yahoo.com

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ABSTRACT

Nutrient analysis was carried out on the leaves and fruits of two variants of okra (*Abelmoschus esculentus*) namely: Clemson spineless and dwarf long green varieties of *A. esculentus* commonly found in Anambra State, Nigeria, to determine their nutritional data with regards to protein, carbohydrate, moisture, ash contents, crude fibre and crude fat contents of *A. esculentus* using standard analytical techniques. Results were analyzed using analysis of variance. The leaves and fruits of the two varieties of *A. esculentus* investigated were found to contain the examined nutrient in varying compositions. Carbohydrate and moisture were higher in the fruits of both varieties of *A. esculentus* (Clemson spineless and dwarf long green) when compared to the leaves (67.09±0.02 and 11.45±0.07), respectively. Ash content, protein, crude fat and crude fibre of *A. esculentus* were higher in the leaves of both varieties when compared to the fruits (9.10±0.14, 21.55±0.21, 5.33±0.18 and 18.68±0.04) of *A. esculentus*, respectively. Protein and ash of *A. esculentus* were higher in the leaves of Clemson spineless when compared to dwarf long green. Crude fat and crude fibre were higher in the leaves of dwarf long green when compared to Clemson spineless. This study has demonstrated that these varieties (Clemson spineless and dwarf long green) of *A. esculentus* examined are power house of nutrients and can contribute significantly to human health. The study revealed that the leaves of *A. esculentus* are more nutritious than fruits. It is concluded from the present study that nutritional trials of both varieties (Clemson spineless and dwarf long green) of okra could be an additional aid to the breeding improvement programme of *A. esculentus*.

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INTRODUCTION

Okra (*Abelmoschus esculentus*), member of the family Malvaceae is a vegetable valued for many of its properties (Ilodibia *et al*., 2016a). It is widely cultivated for its edible green fruits, which are harvested when immature (Kumar, 2014; Ilodibia *et al*., 2016a). The pods of *A. esculentus* have a unique flavour and texture and release slimy mucilage on cooking, which can be used to thicken sauces and add smoothness to soups. Its seed may be roasted and ground to form caffeine – free substitute for coffee (Gemede *et al*., 2015). There are many lines of okra, each with some peculiar quantitative and qualitative characteristics. In the Eastern part of Nigeria, precisely Anambra, there are five varieties. They are; Green emerald, Dwarf long green, the local long pod variety, perkins spineless and Clemson spineless. The two varieties which are the focus of this study are the Clemson spineless and the dwarf long green. The Clemson spineless is long, narrow and do not possess spines; while the dwarf long green variety is shorter, greater in diameter and possess spines. The Dwarf long green variety has a darker shade of green colour than the Clemson spineless (Van, 2005). .

Good nutrition is fundamental for good health. It is the process by which we obtain food and use it for growth, keeping our bodies working properly and warding off diseases. In contrast, lack of nutrition or poor nutrition affects the body in a bad way and has been identified as the most significant factor contributing to the declining health status of indigenous people. It has been linked to heart disease, kidney damage and diabetes (Chopra *et al.,* 2013; Kumar and Chopra, 2013). In children, it can stunt growth, tiredness and lead to poor concentration at school. Okra may be used in developing countries to mitigate malnutrition and alleviate food insecurity (Gemede *et al*., 2015). It is one of the vegetables that are nutritious, affordable and readily available in our area, of which consumed sufficiently could contribute significantly to human health. Determination of the nutrient composition of the available common varieties of *Abelmoschus esculentus* (Clemson spineless and the dwarf long green) in Anambra State, Nigeria was the aim of this study.

MATERIALS AND METHODS

Study area, collection and identification of plant materials: The experiment was carried out at the Emery Biotechnology Laboratory, Ahia-Eke, situated in Umuahia, Abia State. The two varieties of *Abelmoschus esculentus* (Clemson spineless and the dwarf long green) used in this work were obtained between March and April 2016 and authenticated at the Agricultural development project (ADP), Kwata, Anambra state, Nigeria.

Materials and chemicals used for nutrient analysis: The following materials were used in the proximate analysis: Dessicator, muffle furnace, spectrometer, silica dish, Kjeldahl flask, funnel, Soxhlet apparatus, filter paper, thimble, electric oven, grinder, retort stand, test tube and test tube rack, crucible, weighing balance, petri dish. The chemicals used include: Tetrahydrosulphate (vi) acid, Boric acid indicator solution, Sodium hydroxide, Hydrochloric acid, Petroleum ether, Potassium hydroxide, Acetone, Phenolphthaline indicator, Ammonia, Dithezone solution, Carbon tetrachloride, Hydroquinoline, Phenonthroline, Vanado Molybidic acid, Selenium oxide.

Preparation of plant materials for nutrient analysis: Dried leaves and fruits of Clemson spineless and the dwarf long green of *A. esculentus* were ground into fine (100-mesh screen) powder. The ground samples were then examined for carbohydrate, ash content, protein content, crude fat content, crude fibre and moisture content of *A. esculentus* using the standard methods described by Association of Official Analytical Chemist (AOAC, 2005).

Statistical analysis: Data obtained was statistically analyzed using analysis of variance (ANOVA). The Duncan's multiple range tests was used to test the difference among treatments at 0.05% level. Results were presented in Mean±Standard Error.

RESULTS AND DISCUSSION

In the present study, the result revealed that the investigated nutrients of *A. esculentus* were present in all the parts of the *A. esculentus* varieties examined but in varied compositions (Table 1). Carbohydrate and moisture of *A. esculentus* were higher in the fruits of both varieties when compared to the leaves. Ash content, crude fat, crude fibre and protein of *A. esculentus* were higher in the leaves of both varieties when compared to the fruits. The findings are in agreement with Kumar and Chopra (2013) who reported the higher contents of crude protein; crude fibre and carbohydrates in a high yield cultivar (IHR-31) of okra (*Abelmoschus esculentus* L.). During the present investigation, Protein and ash were higher in the leaves of Clemson spineless when compared to dwarf long green. Crude fat and crude fibre were higher in the leaves of dwarf long green when compared to Clemson spineless (Table 1). The leaves and fruits of the two varieties of *A. esculentus* investigated were found to contain the examined nutrient in varying compositions. Carbohydrate and moisture were higher in the fruits of both varieties (Clemson spineless and dwarf long green) of *A. esculentus* when compared to the leaves (67.09±0.02 and 11.45±0.07) of *A. esculentus*, respectively. Ash content, protein, crude fat and crude fibre were higher in the leaves of both varieties when compared to the fruits (9.10±0.14, 21.55±0.21, 5.33±0.18 and 18.68±0.04) of *A. esculentus*, respectively. Protein and ash were higher in the leaves of Clemson spineless when compared to dwarf long green. Crude fat and crude fibre of *A. esculentus* were higher in the leaves of dwarf long green when compared to Clemson spineless of *A. esculentus*. The high content of carbohydrate in the fruits of these varieties makes them a good source of energy. High contents of ash, fat, fibre and protein in the leaves of these varieties of *A. esculentus* make them good sources of these nutrients when compared to some vegetables like *Celosia argentea, Telferia occidentalis* (Ilodibia *et al*, 2016b). The leaves as a vegetable may be eaten as major food plants as supplementary food or cooked in combination with meat or fish, in stew, soup and various preparations (Ilodibia *et al*, 2014). Additionally, proteins are used for building and repairing of body tissues. Fibre aids and speeds up the excretion of waste and toxins from the body, preventing them from sitting in the bowel for too long, which could cause a build-up. High fibre also makes them good forage. Ash content of a plant based food is the function of mineral elements present. Moreover, dietary ash has proved helpful in establishing and maintaining acid-alkaline balance of the blood system (Hawkins, 1979; Ilodibia *et al*., 2014). Fats and oils help to regulate blood pressure and play vital role in the synthesis and repair of important cell parts (Dutta, 2003). The result is in line with work of (Ilodibia *et al*, 2016b and c) who reported similar results among the various parts of *Celosia argentea and Gomphrena celosioides* and (Rekha and Pushpa, 1988) that had same on the seed of *Amaranthus* species.

Table 1. Percent nutrient compositions of Clemson spineless and dwarf long green varieties of Okra (*A. esculentus*).

Parameters	Clemson spineless		Dwarf long green	
	Leaf	Fruit	Leaf	Fruit
Moisture	8.20±0.00^{a}	9.80±0.28^{b}	8.65±0.07^{a}	11.45±0.07^{c}
Ash	9.10±0.14^{b}	2.73±0.17^{b}	8.65±0.07^{a}	2.13±0.11^{a}
CH_2O	39.45±0.12^{b}	67.09±0.02^{c}	39.14±0.02^{a}	65.17±0.16^{a}
Crude fat	4.10±0.14^{a}	1.20±0.00^{b}	5.33±0.18^{b}	2.10±0.00^{c}
Crude fibre	17.60±0.28^{a}	6.40±0.00^{a}	18.68±0.04^{b}	7.30±0.14^{b}
Protein	21.55±0.21^{b}	12.78±0.11^{b}	19.6±0.14^{a}	11.85±0.07^{a}

Results are in Mean ±SD; the same letter in a column is not significantly different by Duncan's multiple range test at ($P<0.05$).

Conclusions

The study has demonstrated that these varieties of *A. esculentus* examined are power house of nutrients. It revealed also that their leaves are more nutritious than fruits. The leaves and fruits of the two varieties of *A. esculentus* investigated were found to contain the examined nutrient in varying compositions. Carbohydrate and moisture of *A. esculentus* were higher in the fruits of both varieties (Clemson spineless and dwarf long green) when compared to the leaves (67.09±0.02 and 11.45±0.07) of *A. esculentus*, respectively. Ash content, protein, crude fat and crude fibre of *A. esculentus* were higher in the leaves of both varieties when compared to the fruits (9.10±0.14, 21.55±0.21, 5.33±0.18 and 18.68±0.04) of *A. esculentus*, respectively. Protein and ash were higher in the

leaves of Clemson spineless when compared to dwarf long green. Crude fat and crude fibre of *A. esculentus* were higher in the leaves of dwarf long green when compared to Clemson spineless. Therefore, the present investigation concluded that the nutritional trials of both varieties (Clemson spineless and dwarf long green) of okra could be an additional aid to the breeding improvement programme *of A. esculentus*.

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