NUTRITIONAL COMPOSITIONS OF SELECTED GREEN LEAFY VEGETABLES IN OYO STATE, NIGERIA

ABSTRACT

The nutritional compositions of selected green leafy vegetables obtained from major towns in Oyo State, Nigeria, (March and April) were determined using standard analytical methods for proximate analysis. The following nutrients in percentage were determined; moisture contents, ash, fat, crude fibre and crude protein. The green leafy vegetable used are *Talium triangulare, Amaranthus hybridus*, *Launaena taraxacifolia Ocimum gratissimum*, *Celosia argentea, Cucuribita maxima, Abelimoschus esculentus, Solanum macrocarpon, Vernonia amygdalina* and *Sesamum indicum*. All nutrients were present in appreciable quantities. Moisture contents ranged from 5.33 ± 0.06% - 8.33 ± 0.06%, ash (23.07 ± 0.06% - 61.27 ± 0.06%), fat (1.13 ± 0.06% - 3.37 ± 0.06%), crude fibre (2.43 ± 0.12% - 22.03 ± 0.06%), and crude protein (18.50 ± 0.10% - 55.23 ± 0.06%). The functional properties of vegetables were close in term of high protein level indicating that they are more nutritious. Also, the level of their ash content showed that the vegetables are very rich in essential minerals for healthy life when compared with one another and recommended dietary allowance (RDA). Thus, there is a need for farmers in the area to engage in dry season vegetable production so as to ensure availability of leafy vegetables throughout the year.

Keywords: Oyo state, proximate, nutritional composition, green leafy vegetables.

INTRODUCTION

Vegetables are the fresh and edible portions of herbaceous plants, which can be eaten raw, or cooked [1, 2]. They contain valuable food ingredients which can be successfully utilized to

build up and repair the body. Vegetables are valuable in maintaining alkaline reserve of the body. Vegetables can be grouped into edible roots, stems, leaves, fruits or seed. Each group contributes to diet in its own way [2]. Leafy vegetables are regular ingredient in the diet of average Nigerian with their level of consumption; they can provide appreciable amounts of nutritive minerals [3]. *Amarathus hybridus*, *Celusia argentea, Abelmoschus esculentus, Talinum triangulare, Vernonia amygdalina* and *corchorus olitorious* are popular edible vegetables in Nigeria. *Corchorus olitorius* is usually recommended for pregnant women and nursing mothers because it is believed to be rich in iron [4].

Most developing countries depend on starch-based food as the main staple food for the supply of both energy and protein. This account in part for protein deficiency which prevails among the populace as recognized by Food and Agricultural Organization [5].

Apart from the variety which they add to the menu [6, 7], they are valuable sources of nutrients especially in rural areas where they contribute substantially to protein, minerals, vitamins, fibers and other nutrients which are usually in short supply in daily diets [8]. It is worthwhile to note that consumption of numerous types of edible plants as sources of food could be beneficial to nutritionally marginal population especially in developing countries where poverty and climate is causing havoc to the rural populace [9]. African indigenous leafy vegetables (ALVs) are the cheapest and most readily available sources of important proteins, vitamins, especially the pro-vitamin A [9] and essential amino acids. Vegetables rank higher in production than all other crops; they are known to provide 80% of the vitamin A in diet [10]. Indigenous vegetables are reported to play a very important role in income generation and subsistency [11]. They are important commodities for poor households because their prices are relatively affordable when compared to other food items. Vegetables provide very important sources of employment for those outside the formal sector in urban areas because of their generally short, labour intensive production systems, low levels of

52 investment and high yield [11]. A large number of African indigenous leafy vegetables have
53 long been known and reported to have health protecting properties and uses [12]. It is
54 reported that the roots, leaves and twigs, as well as the bark of the tree of Moringa plants
55 (*Moringa oleifera*) are used in traditional medicine [13].
56 The WHO recommended a minimum daily intake of 400 g of fruits and vegetables [14].
57 However, it is not clear from the report what proportion of this total daily intake should go to
58 vegetables. Nevertheless, according to the Kobe framework document and an FAO report, the
59 recommended total daily intake is equivalent to five (5) servings of 80 g each of fruits and
60 vegetables [15, 16]. Vegetables are full of water, especially when eaten raw, and when eaten,
61 the body does not need to use some of its own water to digest them. This means less pressure
62 is put on the digestive systems [17]. Green leafy vegetables like cabbage, lettuce, dandelion,
63 and Moringa may be eaten raw, boiled or dried. Perhaps the most common use in all parts of
64 the world is boiled vegetable leaves. This process eliminates potential pathogens, sometimes
65 poisonous or irritating substances are neutralized and spoilage is brought to a halt [18].
66 In Nigeria, as in most other tropical countries of Africa where the daily diet is dominated by
67 starchy staple foods, vegetables are the cheapest and most readily available sources of
68 important proteins, vitamins minerals and essential amino acids [2]. Vegetables also act as
69 buffering agents for acidic substances produced during the digestion process [2].
70 Traditional African leafy vegetables are better adapted to the environment than the introduced
71 exotic vegetables and also provide low-cost quality nutrition for large parts of the population
72 in both rural and urban areas [19]. Inadequate information on these vegetable species is
73 causing gradual neglect of some of the useful ones that have been used for food over the
74 years. Vegetables are a vital constituent of West African diet, and traditional vegetable
75 species are highly important yet, many species are poorly known, being used only locally
76 [20]. The objective of this study is to evaluate the nutritional value of some leafy vegetables

consumed in Oyo State South West of Nigeria to give more information that are lacking on the importance of these vegetables on the nutrient they supply.

MATERIALS AND METHODS

Eleven leafy vegetables were collected from different locations within the study area (Ibadan, Ogbomoso, Oyo, Igboora, Iseyin, and Saki all in Oyo State) between months of March and April 2016. Vegetable collected includes *Talium triangulare, Amaranthus hybridus*, *Launaena taraxacifolia Ocimum gratissimum*, *Celosia argentea, Cucuribita maxima, Abelimoschus esculentus, Solanum macrocarpon, Vernonia amygdalina* and *Sesamum indicum* (English/Common and Local name shown in Table 1). They were identified and authenticated at department of Botany, University of Ibadan, Nigeria. The vegetables were air-dried at room temperature (25^{o}C) and ground to fine powder, using a laboratory mill and stored in air-tight containers for laboratory analysis. The nutritional compositions in terms of proximate analysis were carried out to determine Moisture contents, crude protein, crude fibre, fat, and ash. All analysis was carried out in triplicates.

NUTRITIONAL ANALYSIS

The moisture content of the vegetable samples was determined after drying at 105 ºC in an electric oven (model: UNISCOPE5M9053) until a constant weight was attained [21]. The micro-Kjeldahl method was employed to determine the total nitrogen and the crude protein (N×5.95) [21]. A dry ashing method was used to determine the ash content [21]. The samples were ashed in a furnace (model: SXL) at 550 °C. Crude fat was determined by Soxhlet extraction and crude fiber by incineration method after acid and base digestion.

STATISTICAL ANALYSIS

Three determinations were carried out for each analysis. The mean value and standard deviation were separated using Duncan's Multiple Range Test (DMRT) at $p \geq 0.05$.

RESULTS AND DISCUSSION

Table: 1. Botanical, English/Common and Local name of the vegetable samples

Botanical name	English name	Local name
Amaranthus hybridus	Smooth amaranth	Tete
Talinum triangulare	Water leaf	Gure
Launaena taraxacifolia	Wild lettuce	Yanrin
Ocimum gratissimum	African basil	Efinrin
Cucuribita maxima	Winter squash	Gboro
Ocimum canum	African mint	Marugbo
Celosia argentea	Cocks comb	Soko
Solanum macrocarpon	African eggplant	Igbo/Gbagba
Abelmoschus esculentus	Okro leave	Ilasa
Vernonia amygdalina	Bitter leaf	Ewuro
Sesanum indicum	Sesame	Ekuuku/Morogbo

Table: 2. Proximate Composition of green leafy Vegetable Samples

Leafy Vegetables	Moisture (%)	Ash (%)	Fat (%)	Crude Fiber (%)	Crude Protein (%)
Amaranthus hybridus	5.50 ± 0.10^{b}	27.53 ± 0.06^{a}	3.37 ± 0.06^{a}	10.07 ± 0.06^{a}	55.23 ± 0.06^{a}
Talinum triangulare	7.70 ± 0.10^{b}	40.10 ± 0.10^{b}	3.23 ± 0.06^{a}	20.07 ± 0.12^{b}	25.30 ± 0.10^{b}
Launaena taraxacifolia	5.33 ± 0.06^{a}	23.07 ± 0.06^{a}	1.30 ± 0.00^{a}	20.10 ± 0.10^{a}	50.10 ± 0.10^{b}
Ocimum gratissimum	7.73 ± 0.06^{a}	46.2 ± 0.00^{c}	1.37 ± 0.06^{a}	10.10 ± 0.10^{b}	32.63 ± 0.06^{a}
Cucuribita maxima	6.17 ± 0.06^{a}	50.27 ± 0.06^{a}	1.13 ± 0.06^{a}	10.07 ± 0.12^{a}	30.47 ± 0.06^{a}
Ocimum canum	6.77 ± 0.06^{a}	23.13 ± 0.06^{a}	1.20 ± 0.00^{a}	20.13 ± 0.12^{a}	47.13 ± 0.12^{b}

Celosia argentea	6.33 ± 0.06 [a]	40.13 ± 0.06 [a]	2.67 ± 0.06 [a]	22.03 ± 0.06 [a]	20.20 ± 0.17 [c]
Solanum macrocarpon	6.27 ± 0.06 [a]	54.03 ± 0.06 [a]	2.20 ± 0.10 [b]	2.43 ± 0.12 [b]	23.10 ± 0.10 [b]
Abelmoschus esculentus	6.23 ± 0.06 [a]	61.27 ± 0.06 [a]	3.40 ± 0.10 [b]	7.60 ± 0.10 [b]	20.10 ± 0.00 [c]
Vernonia amygdalina	7.27 ± 0.06 [a]	58.33 ± 0.15 [c]	2.47 ± 0.06 [a]	10.17 ± 0.06 [a]	19.20 ± 0.17 [b]
Sesanum indicum	8.33 ± 0.06 [a]	58.17 ± 0.06 [a]	2.33 ± 0.06 [a]	10.13 ± 0.06 [a]	18.50 ± 0.10 [a]

Mean values ± Standard deviation values. Values carrying different letter within a column are significantly different at P>0.05.

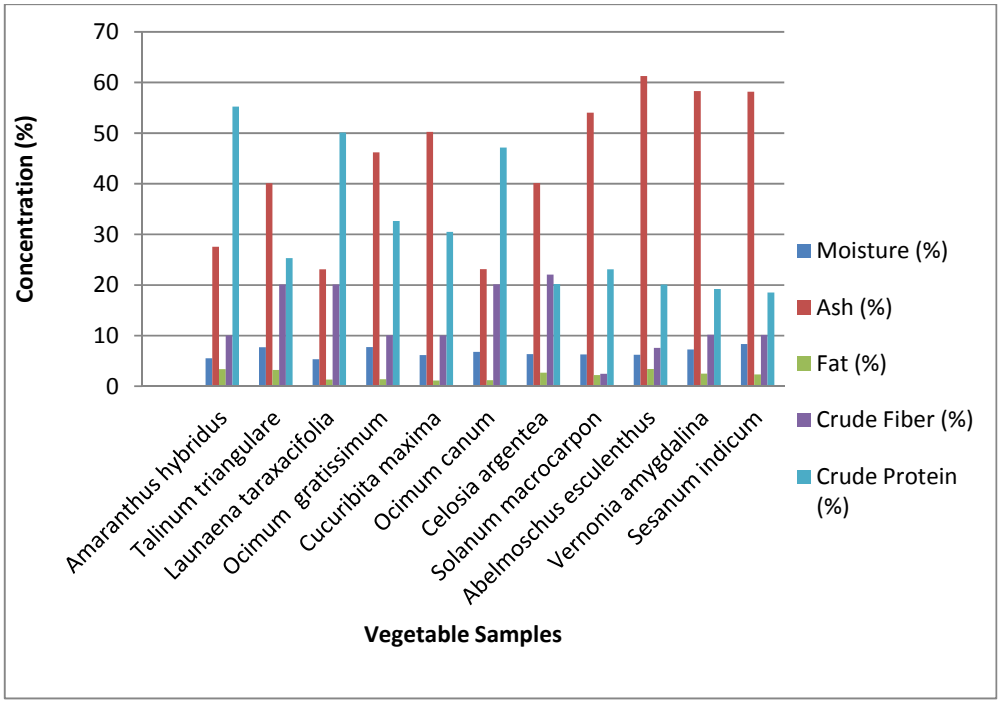

Figure: 1. Graphical comparison of vegetables nutritional composition in percentage.

The proximate composition of the eleven green leafy vegetables and Graphical comparison of vegetables nutritional composition in percentage are shown in the Table 2 and Figure 1 respectively and Botanical, English/Common and Local name in Table 1 [22].

The eleven leafy vegetables showed moisture content ranges from 5.33% to 8.33% (Table 2 and Figure1). The results obtained were close to that reported for *Basella alba (*11.57%) and *Amaranthus hybridus* (10.00%) by Asaolu *et al*. [23], *Cleome gynandra* (15.90%) reported by Clement [19] and 15.6% for *Celusia argentia* by Onwordi *et al.* [2]. In this study, it was

observed that a closer relationship occurred between the moisture content of the leafy vegetables under study, but a great difference was observed when compared with the one reported by Idris *et al.* [24] for *Abelimoschus esculentus* (82.53%) and 79.98% reported for *Corchorus olitorious* by Adeniyi *et al.* [25]. Also, as it has been reported in the work of Kwenin *et al.* [17] that leafy vegetables have high moisture content ranging from 72.93% to 91.83%, the significant difference observed now may be due to the cultivation conditions that influence the water level of vegetables [26]. George [27] stated that moisture content makes an important contribution on the texture of the leaves and helps in maintaining the protoplasmic content of the cells; it also makes them perishable and susceptible to spoilage by microorganisms.

The highest result was recorded for *A. esculentus* (61.27%) while *Launaena taraxacifolia* had the least value of 23.07%. Ash, according to Mc Clement [28] is the inorganic residue which provides a measure of the total amount of minerals present in food. There were significant interactions among the samples used in this study and a great difference was obtained when compared with the ash content range of 10.0% - 12.5% recorded for *Cleome gynandra* by Clement [19].

Therefore the small difference observed when these vegetables are compared with one another, and the immense difference observed when compared with the vegetables studied by another scientist above may be of the fact that, there is different concentration of minerals in the soil onto which they were planted. Crude fibre ranged from 2.43% (*S. macrocarpon*) to 22.03% (*Celosia argentea*) (Table 2 and Figure 1), this fell within the range (8.50 - 20.90%) reported by Isong and Idiong [29] for some Nigerian vegetables. Dietary fibre helps to prevent constipation, bowel problems and piles. High crude fibre in the vegetable according to CFW [30] could also help in blood cholesterol attenuation, as well as blood glucose attenuation when consumed. The fibre content recorded in this study were in line with 6.0 g/

146 100 g to 6.33 g /100 g reported by Hassan *et al*. [31] and also in line with the result obtained
147 for crude fibre content of Asaolu *et al*. [23] which ranges from 8.05% to 12.08%. Therefore,
148 *Celosia argentea, Launaena taraxacifolia*, *Talinum triangulare* and *Ocimum canum* are good
149 source of crude fibre as suggested by this study which could be of immense health benefit to
150 their consumer which follows Clement [19] reports that an increased intake of dietary fibre
151 appears to be useful in treatment of both obesity and diabeties.

152 The crude fat content in this study ranges from 1.20% to 3.40% (Table 2 and Figure 1), where
153 high values were observed for *Abelmoschus esculentus, Amaranthus hybridus and Talinum*
154 *triangulare.* Asaolu *et al*. [23] study, reported 3.51% to 14.02% range for crude fat in
155 *Amaranthus hybridus, Indian spinach and Telfaira occidentalis.* Vegetables with high
156 Dietary fats represent the most compact chemical energy available to man [32].

157 The protein content of the vegetables ranged from 18.50 % to 55.23 % with *Amaranthus*
158 *hybridus* showing the highest value followed by *Launaena taraxacifolia and Ocimum canum*
159 among others (Table 2 and Figure 1). It is also in accordance to the result reported by Asaolu
160 *et al*. [23] which ranges from 46.56% to 66.60%. Plant foods that provide more than 12% of
161 their calorific value from protein have been shown to be good source of protein [33]. This
162 shows that all the leafy vegetables investigated are all good sources of protein. Protein help in
163 building and maintaining all tissue in the body forms an important part of enzymes, fluid and
164 hormones of the body and also helps form antibodies to fight against inaction and supplies
165 energy [34]. Proteins help in building and maintaining all tissues, forms an important part of
166 enzymes, fluids, hormones of the body and form antibodies (immunoglobulin) that fight
167 against infections and supplies energy [19]. The protein content of vegetables in this study
168 was high, showing that they are more nutritious.

The level of protein in the vegetables generally indicates that they are very important for human health and are good supplements for people living below the poverty level, especially in the rural areas.

CONCLUSION

The result of this research work showed that all the vegetables used in this study are more nutritious because they are very good source of protein. Also, their fibre contents were a bit low but when consumed, could correct body abnormalities such as obesity and diabetes. Also, their low fat content level indicated that, they are good for human health because they will not easily provide additional calories to the body when ingested. High ash contents indicate that, they are vital source of minerals (Na, K, Fe, Zn, Cu, Ca and P), particularly Ca could be helpful in building up strong teeth and bones, and also prevent haemophilia in blood.

Farmers should continue engaging in vegetable production and marketing. The farmers should be motivated by the government, especially the local government with provision of effective measures that could guide against any factor which may hinder the productivity of the vegetables. In addition, for sustenance of poor people in some rural areas, leafy green vegetables are very important and should therefore be an effective and efficient means of transportation to other parts of the country where productivity is low.

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