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Abstract- Several vegetable species abound in Nigeria and most West African countries where they are used partly as condiments or spices in human diets or as supplementary feeds to livestock. There were ten samples of vegetable used in this study and were analyzed for a major source of ascorbic acid and the mean values ranged from 170 – 425 mg/100 g, *Celosia argentea* "Soko" (425 mg/100 g) and *Amaranthus hydridus* "tete" (408 mg/100 g) both having the highest ascorbic acid while *Corchorous olitorius* "ewedu" (170 mg/100 g) had the least ascorbic acid. *Amaranthus hydridus* and *Talinum triangulare* had the highest mineral contents. Carbohydrate contents ranged from 3.9 – 48.2 g/100 g, *Ocimum gratissium* "efirin" having 3.9 g/100 g while *Vernonia amygdalina* "ewuro" had 48.2 g/100 g. Protein content ranged from 5 –28.2 g/100 g.

Keywords: *vegetables; phytochemical constituents; nutritional values.*

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Phytochemical and Nutritional Constituents of Some Common Vegetables in South-West, Nigeria

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Abstract- Several vegetable species abound in Nigeria and most West African countries where they are used partly as condiments or spices in human diets or as supplementary feeds to livestock. There were ten samples of vegetable used in this study and were analyzed for a major source of ascorbic acid and the mean values ranged from 170 – 425 mg/100 g, *Celosia argentea* "Soko" (425 mg/100 g) and *Amaranthus hydridus* "tete" (408 mg/100 g) both having the highest ascorbic acid while *Corchorous olitorius* "ewedu" (170 mg/100 g) had the least ascorbic acid. *Amaranthus hydridus* and *Talinum triangulare* had the highest mineral contents. Carbohydrate contents ranged from 3.9 – 48.2 g/100 g, *Ocimum gratissium* "efirin" having 3.9 g/100 g while *Vernonia amygdalina* "ewuro" had 48.2 g/100 g. Protein content ranged from 5 –28.2 g/100 g. *Talinum triangulare* "gbure" had the lowest while *Corchorous olitorius* had the highest protein content. Fiber content ranged from 1.0 – 11.5 g/100 g *Vernonia amygdalina* had the lowest fiber content while *Senecio biafrae* had the highest. The analysis of the samples also showed the presence of flavonoids, alkaloids, saponins, inulins and tannins, this indicates that the vegetables studied contain an appreciable amount of bioactive compounds. This research analyzed the phytochemical and nutritional values of these vegetables with a view to ascertain their nutritional composition for appropriate recommendation if need arises.

Keywords: vegetables; phytochemical constituents; nutritional values.

I. Introduction

The amounts of the nutrient constituents in the commonly used leaf vegetable species in Nigeria have been studied to some extent, the lesser known regional and local species remain virtually neglected (Kola, 2004). Lack of information on the specific nutrients and phytochemicals in a large number of the native vegetables species with which Nigeria is richly endowed is partly responsible for their under exploitation especially in areas beyond the traditional localities where they are found and consumed. Among the leafy vegetables in which their phytochemicals and nutrients have not been extensively studies are leaves of water leaf among others (Ezekwe et al., 2001).

Vegetables contain various medicinal and therapeutic agents. There are large arrays of laxatives, sedatives and soporifics or sleep inducing components in the vegetable kingdom. Vegetables like onions act as tonic and are excellent for the nerves. Certain vegetables are highly beneficial in the treatment of various diseases. Spinach is beneficial in the treatment of kidney troubles. Lettuce can be used as a food remedy for insomnia. Water leaf has been also implicated medically in the management of cardiovascular diseases like stroke, obesity, and so on (Adewunmi and Sofowora, 1980). The "Efirin" (scented leaf) serves as a decongestant for head, colds, bronchitis and sinusitis. Also, the leaf is chewed traditionally for all tooth and gum disorders.

This study was carried out to evaluate the phytochemical and the nutritional composition of common vegetables so as to put into literature the significance of eating these common vegetables in southwest Nigeria. Further research may wish to concentrate on the anti-microbial properties of these valuable vegetables commonly found in the south western Nigeria.

II. Materials and Methods

a) Collection of Samples

Samples of vegetables were randomly selected from popular local markets in Osogbo. All samples were randomly collected aseptically in a sterile foil paper and a sterilized container which are tied and labelled appropriately in readiness for phytochemical and nutritional analysis.

b) Preparation of Extracts

The analysis determined the biologically active compounds that contribute to the flavour, colour and other characteristics of vegetables. Hundred gram of each vegetable sample was washed with deionised water to remove dust particles, the leaves were sun dried for 3 - 4 days. The leaves were later milled to obtain the powder using an electric blender, the powder were soaked in 360ml of sterile distilled methanol and 240ml of sterile distilled water in ratio 3 : 2 for four days at 30°C – 32 ° C. The extracts were filtered through a

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Millipore filter (0.25µm). The resulting filtrates were concentrated under reduced pressure at 50°C and then transferred into a well labelled sterile bottle (Kumar et al. 2009).

c) Test for Alkaloids

About 1% HCl and 6 drops of Mayer's reagent and Dragendroff"s reagent was added to the extract. The organic precipitate indicates the presence of alkaloids (Kumar *et al*. 2009).

d) Test for Flavonoids

About 5ml of dilute ammonia solution was added to the extract of each samples, followed by addition of con. H_2SO_4. A yellow coloration confirms the presence of flavonoids which disappeared immediately (*Ayoola et al.* 2008)

e) Test for Saponins

Exactly 20ml of distilled water was measured in a graduated cylinder for 15 minutes, formation of foam (about 1cm layer of foam) indicated the presence of saponins (Kumar *et al.* 2009).

f) Test for Tannins

Few drops of lead acetate were added to about 5ml of the extract, the formation of a yellow precipitate indicated the presence of tannin (Edeoga *et al.* 2005).

g) Test for Carbohydrate

About 2 drops of Molisch's the extract was added to 2ml of the sample extract in a test tube and mixed thoroughly, while the 2ml of con.H_2SO4 was added. A reddish violet color appeared immediately which indicated the presence of carbohydrates.

h) Test for Protein

Two ml of protein solution and 40% NaOH solution and 1 to 2 drops of 1% $CuSO_4$ solution was added. A violet color indicated the presence of peptide linkage of the molecule.

i) Test for Ascorbic acid

To the extract, 10 drops starch solution was added with the aid of a pipette and it was stirred using a toothpick, iodine solution was added in drops until a color that persisted longer than 20 seconds which is the endpoint. The color change indicated the presence of Vitamin C (Omaha 2011).

j) Determination of Moisture content

The wet weight of the fresh vegetable leaves (samples) was recorded before placing them in a hot air oven at 1000° C for an hour for the complete evaporation of water. The sample was taken out, cooled and weighed to obtain the dry weight. The dry weight was subtracted from the wet weight to get the moisture content.

k) Determination of Mineral content

Milled samples (5 g) were dry-ashed in a furnace at 550° for 24 hours. The resulting ash was cooled in a desiccator weighed. Two ml of concentrated HCl, were added to dissolve the ash and a few drops of concentrated HNO_3 were added. The solution was placed in a boiling water bath and evaporated almost to dryness. The contents were then transferred to 100 mL volumetric flask and diluted to volume with deionized water and appropriate dilutions were made for each samples before analysis. Calcium, magnesium and iron contents were quantified using atomic absorption spectrophotometer while Sodium and potassium were determined with a flame photometer or Gallenkamp (AOAC, 1990).

III. Results

The studies revealed that the *Ocimum gratissimum* had 189g/100gDM of Ascobic acid compared to *Corchorous olitorus* that had about 170 g/100g DM. The carbohydrate content of the samples was discovered to be 3.9 g/100g DM in *Ocimum gratissimum* while 27.1 g/100g DM was obtained for *Corchorous olitorus*. The protein constituent was estimated to be 5.4 g/100g DM in *Ocimum gratissimum* while 28.2 was observed for *Corchorous olitorus*. The moisture content of the vegetable samples was discovered to be 32.2 g/100g DM in *Ocimum gratissimum* while 27.5 g/100g DM was obtained for *Corchorous olitorus*. The fiber content of the vegetable was discovered to be 11.5 g/100g DM in *Ocimum gratissimum* and 9.2 g/100g DM was obtained for *Corchorous olitorus*.

The ascorbic content of *Solanum macrocarpon* 340 g/100g DM was less than that of *Vernonia amygdalina* 348 g/100g DM, the carbohydrate content was 48.2 g/100g DM and 6.4 g/100g DM respectively for *Vernonia amygdalina* and *Solanum macrocarpon*.The protein constituents of *Vernonia amygdalina* and *Solanum macrocarpon* were 14.9 g/100g DM and 4.6 g/100g DM respectively while the moisture contents were estimated to be 21.9 g/100g DM and 85 g/100g DM for *Vernonia amygdalina* and *Solanum macrocarpon* espectively. The fibre content was estimated for 1.0 g/100g DM and 1.6 g/100g DM for *Vernonia amygdalina* and *Solanum macrocarpon* respectively. The *Senecio biafrae* had the least ascorbic acid when compared with *Celosia argentea*, *Amaranthus hybrides*, *Talinum triangulare*, *Hisbiscus esculenta* and ugu. Whereas the *Senecio biafrae* (30.0 g/100g DM) showed the highest carbohydrate constituents when compared with *Celosia argentea*, (4.0 g/100g DM), *Amaranthus hybrides* (7.0 g/100g DM) *Talinum triangulare* (4.8 g/100g DM) *Hisbiscus esculenta* (10.6 g/100g DM) and *Telfaria occidentalis* (6.9 g/100g DM). The *Senecio biafrae* is highly proteinous by showing up to 12.3 g/100g DM being the highest when compared with the protein contents of *Celosia argentea* (6.2 g/100g DM), *Amaranthus hybrides* (4.6 g/100g DM), *Talinum triangulare* (5.0 g/100g DM) , *Hisbiscus esculenta* (5.2

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g/100g DM) and *Telfaria occidentalis* (4.7 g/100g DM). The *Talinum triangulare* had the highest moisture content(93 g/100g DM) when compared with all other vegetable samples.The fibre content was highest in *Senecio biafrae* (11.8 g/100g DM) as shown in the table 1.

About four mineral elements were established in the analysis. These elements include: Calcium (Ca), Potassium (K), Magnesium (Mg), Sodium (Na) and Iron (Fe). The *Senecio biafrae* had the highest Ca (2.67 mg/100 g) content among other vegetables sampled while the least content was found in *Ocimum gratissimum* (1.23 mg/100 g).The potassium content was maximum in *Talinum triangulare* when compared with other vegetables. However, the minimum potassium content was found in *Ocimum gratissimum* (2.35 mg/100 g).The magnesium content of the vegetables was found to be maximum in "tete" (2.54 mg/100 g) while the least magnesium content was discovered in *Ocimum gratissimum* (0.44 mg/100 g).The sodium content of the vegetable samples was maximum in *Amaranthus hybridus* (6.85 mg/100 g) while the least sodium content was found in *Vernonia amygdalina* (0.04 mg/100 g).The iron content of the vegetables was maximum in *Amaranthus hybrids* (0.13 mg/100 g).However the minimum iron content was found in *Vernonia amygdalina* (0.03 mg/100 g).

The *Ocimum gratissimum* and *Corchorous olitorus* showed the presence of all the constituents while *Vernonia amygdalina* showed the presence of all the constituent that is alkanoid, flavonoid,saponoid inulin except saponin. *Solanum* and *Senecio biafrae* did not exhibit the presence of inulin whereas all other phytochemical constituent were exhibited.*Celosia* showed the presence of all the phytochemical constituents except saponin. However, the *Amaranthus hybrides* exhibited all the phytochemical constituents including saponin.Inulin was absent in *Talinum triangulare*, *Hibiscus esculenta* and *Telfaria occidentalis* while other phytochemical constituent were present. However, *Telfaria occidentalis* did not exhibits the presence of saponin.

IV. Discussion

Nutrients are necessary for life and good health; these may be found in a number of different foods. The general function of nutrients includes energy, building materials for body structures and regulations and control of body processes. The proximate analysis showed that the studied vegetables are good sources of carbohydrate and protein; especially *Vernonia amygdalina* and *Corchorus olitorius*. The carbohydrates and proteins present in these vegetables may be a conglomerate of bioactive sugars, glycoproteins or proteins which gives most of the vegetables their medicinal potency against certain diseases.

Some plants are known to contain certain sugars which are biologically active against some diseases (Srivastava et al., 1989). The elements such as calcium, magnesium, potassium, iron and sodium found in small amount in the leaves are nutritionally and biochemically important for proper body function. For instance, calcium is known to play a significant role in muscle contraction, bone and teeth formation and blood clotting (Ahmed and Chaudhary, 2009; Heaney, 2009).

Some of these minerals such as magnesium are needed as cofactor in enzyme catalysis in the body (Ahmed and Chaudhary, 2009). Sodium and potassium which are present in the intracellular and extracellular fluid helps to maintain electrolyte balance and membrane fluidity. Iron is known to be a component of some metalloenzymes, myoglobin and heamoglobin (Ahmed and Chaudhary, 2009), which is needed in the transport of oxygen and carbon dioxide during respiration or cellular metabolism. This heamoglobin (containing iron) also serve as buffer to regulate changes in blood pH (Kamshilov and Zaprudnova, 2009). It is known that inorganic mineral elements such as potassium, calcium play important roles in the maintenance of normal glucose-tolerance and in the release of insulin from beta cells of islets of Langerhans (Choudhary and Bandyopadhyan, 1999). Iron is an essential trace element for haemoglobin formation and normal functioning of the central nervous system (Adeyeye and Otokiti, 1999).

The study also shows that vegetables contain small amount of fiber, this could be beneficial when consumed. Dietary fibre is important for lowering blood cholesterol and blood sugar. It is known to reduce the risk of diseases such as obesity, diabetes, breast cancer, hypertension and gastrointestinal disorder (Saldanha, 1995).

The presence of secondary metabolites such as alkaloids, saponins, tannins, flavonoid and Inulin in the vegetables may contribute to its medicinal value. Some of these compounds are well documented to exhibit hypoglyceamic activity in animals (Akhtar et al., 1981). Saponins inhibit Na^+ efflux leading to higher Na^+ concentration in cells, thereby activating a Na^{+-} Ca^{2+} antiport (Schneider and Wolfing, 2004). This effect produces elevated cytosolic Ca^{2+} which strengthens the contraction of the heart muscle and thereby reducing congestive heart failure (Schneider and Wolfing, 2004). Traditional leafy vegetables have proven nutritive value in terms of having more protein, minerals and carbohydrate than some exotic vegetables.

V. Conclusion

The vegetables sampled for analysis exhibited some forms of nutritional values which enable the plant to be known for having therapeutic traces. It is to be noted that vegetables contain some certain nutritional

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elements which will make the plants to be source nourishment for the body. It will also promote good health and proper functional mechanism in the body.

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Table 1 : Nutritional values of some the vegetable samples.

Nutritional value of some Vegetable samples (g/100 g DM)					
Samples	Ascorbic acid	Carbohydrate	Protein	Moisture	Fiber
Ocimum gratissimum	189	3.9	5.4	32.2	11.5
Corchorous olitorus	170	27.1	28.2	27.5	9.2
Vernonia amygdalina	348	48.2	14.9	21.9	1.0
Solanum macrocarpon	340	6.4	4.6	85.6	1.6
Senecio biafrae	203	30	12.3	28	11.8
Celosia argentea	425	4.0	6.2	84	1.1
Amaranthus hybrids	408	7.0	4.6	86	1.8
Talinum triangulare	284	4.8	5	93	1.4
Hisbiscus esculenta	221	10.6	5.2	26.5	2.9
Telfaria occidentalis	345	6.9	4.7	92	2.7

Table 2 : Mineral contents of some the Vegetable samples.

Mineral contents of the samples (mg/100g)					
Samples	Ca	K	Mg	Na	Fe
Ocimum gratissimum	1.23	2.35	0.44	0.76	0.04
Corchorous olitorus	1.27	3.84	0.60	0.34	0.05
Vernonia amygdalina	2.26	3.76	0.46	0.04	0.03

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Solanum macrocarpon	2.43	5.67	1.93	4.56	0.07
Senecio biafrae	2.47	3.74	1,32	4.85	0.05
Celosia argentea	2.67	3.94	1.42	5.23	0.06
Amaranthus hybrids	2.06	4.83	2.54	6.85	0.13
Talinum triangulare	2.45	6.11	2.23	0.29	0.44
Hisbiscus esculenta	2.48	4.75	1.83	0.35	0.07
Telfaria occidentalis	1.74	2.46	0.66	1.18	0.04

Table 3 : Phytochemical Screening of some of the vegetable samples.

Samples	Alkaloid	Flavonoid	Saponin	Tannin	Inulin
Ocimum gratissimum	+	+	+	+	+
Corchorous olitorius	+	+	+	+	+
Vernonia amygdalina	+	+	+	-	+
Solanum macrocarpon	+	+	+	+	-
Senecio biafrae	+	+	+	+	-
Celosia argentea	+	+	-	+	+
Amaranthus hybrides	+	+	+	+	+
Talinum triangulare	+	+	+	+	-
Hisbiscus esculenta	+	+	+	+	-
Telfaria occidentalis	+	+	-	+	-

(+) = positive; (-) = negative

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