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Proximate Analysis and Nutritive Values of Ten Common Vegetables in South -West (Yoruba Land) Nigeria

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ABSTRACT:

The proximate and mineral compositions of ten commonly eaten leafy vegetables in South-West Nigeria were determined. The vegetables varied in their composition both in terms of major food, classes (proximate) and the mineral compositions. The proximate range (%): 5.69-24.70(ash), 8.53-17.32(moisture), 1.21-30.59(fat), 10.40-21.15(fibre), 14.60-26.33(crude protein) and 4.72-56.50(carbohydrate). Pb was not detected in any of the samples, while Na, K, Ca, Mg, Zn, Fe, Cu, Mn and P were present in appreciable levels. The ten leafy vegetables were found to be good sources of nutrients to human body. The vegetables might play major roles in the economy of the farmers and rural dwellers. Efforts have to be made to cultivate these vegetables in large quantities so that they will be readily available for people in cities and towns.

Keywords: Proximate Analysis; Nutritive Values; Common Vegetables; Yoruba Land.

INTRODUCTION

Green leafy vegetables constitute an indispensable constituent of human diet in West Africa (Oguntona, 1998; Schippers, 2000). Some are cultivated while some occur in the wild (Tindall, 1968; Tindall, 1983; Grubben, 1977; Chouldhury, 1997). They play good roles in the economy of local or rural dwellers (Epenhujsen, 1974; Oomen and Grubben, 1973; Martin and Telek, 1979; Nath, 1976; Oches and Bakhuizen, 1980). Their importance to people has been documented more than seven decades ago (Dalziel, 1937; Burkill, 1997). Their economic values to man especially to rural dwellers cannot be ignored (Omotayo, 2001; Kocchar, 2009; Pandey, 2010; Purseglove, 1968). In West Africa, the plants including the ones with ancient introduction have been described and properly documented being the pioneering works in West Africa floristics (Hutchinson *et al*, 1954; Hutchinson *et al*, 1963). Also the plants have been ethnobotanically studied and their local names documented (Omotayo, 2001, Omotayo, 1997). Green leafy vegetables are not only useful to man but also to his domesticated animals (McDonald *et al*, 1995; Ranjhan, 2001).

It has been observed in Nigeria that life expectancy among rural dwellers is higher than those in urban areas and the reason for this is not far-fetched; the rural dwellers depend on nature whereas most of the people in cities, though they still take leafy vegetables, feed mostly on synthesized products more than nature. In our previous work, we reported the amino acid composition of ten commonly eaten indigenous leafy vegetables of South-West, Nigeria. The present research was conducted to investigate the proximate and mineral composition of these vegetables, as these could be the contributing factors to their health beneficial effect.

MATERIALS AND METHODS

The leafy vegetables examined were*: Amaranthus cruentus, L., Amaranthus dubius. L, Basella alba. L., Cnidoscolus aconitifolius, Corchorus olitorius, Ocimum gratissimum L., Solanum macrocarpon. L., Talinum fruticosum (L) Juss; Telfairia occidentalis, Hook. F and*

Vernonia amygdalina. Del. Their families and their local names are listed in table 1. These vegetables were selected for the purpose of this research based on their availability, agronomic superiority and popularity. The fresh leaves of vegetables were harvested fresh from Ikere-Ekiti, Ado-Ekiti and sub-urban/rural areas around Akure town in South-Western part of Nigeria. These towns are located in the humid tropical rainforest with average rainfall of 1150-2000m with utisols as the predominant soil type. The vegetables were washed to remove all dirt after which they were cut into bits; air dried for two weeks and then blended using a mechanical blender. The samples were labelled as 1-10 in alphabetical order and stored in air tight containers, pending analysis.

PROXIMATE ANALYSIS

The routine-analysis of food is termed the proximate or wende analysis (which followed the name of an experimental station 'wende' in Germany, a place well known for its experience in routine analysis which was developed by two German Scientists; Henneberg and Stohman in 1865) (McDonald *et al,* 1995). The procedures for proximate analysis (moisture, ash, crude protein, crude fibre, ether extract (crude fat) and nitrogen free extractives or soluble carbohydrate), were by the methods descried by (AOAC, 2005; Meyer, 2004; Nielson, 2005; Pomeranz and Meloan, 2004; Wong, 2005).

MINERAL ANALYSIS

The minerals were determined using appropriate methods as illustrated by Pomeranz and Meloan, 2004; Nielssen, 2005; AOAC, 2005. 5g of each sample was dry-ashed in an electric furnace at 550^{o}C for 24 hours. The resulting ash was cooled in a desiccator and weighed. The ash was dissolved with 2ml of concentrated HCl and few drops of concentrated nitric acid (HNO_3) were added. The solution was placed in boiling water bath and evaporated more or less to dryness. The content was then transferred to 100ml volumetric flask and diluted to volume with deionized water. Appropriate dilutions were made for each element before analysis which was

determined by Atomic Absorption Spectrophotometry (Pye, Unican SP9, Cambridge, UK).

RESULTS AND DISCUSSION

The results of the proximate composition of ten commonly eaten vegetables selected for this research work which included *Amaranthus cruentus*, *Amaranthus dubius*, *Bosella alba*, *Cnidoscolus aconitifolius, Corchorus olitorius, Ocumum gratissimum, Solanum macrocarpon, Talinum fruticosum, Telfaina occidentalis* and *Vernonia amygdalina* are presented. Table 1 presents the ten leafy vegetables with their scientific names, families, English and common/local names in the areas where they were obtained. Table 2 shows that the leaves moisture contents are 10.04%, 10.03%, 10.34%, 17.03%, 12.02%, 8.53%, 10.34%, 17.32%, 10.90% and 10.96% respectively. The scores are low and could be attributed to the period of sampling which was about onset of dry season/ the harmattan period, a season characterized by intensive sunlight and dryness. Moisture content makes important contribution to the texture of the leaves and help in maintaining the protoplasmic content of the cells. The values are high, compared to the reported values for *M. scandens* leaves 7.24% (Omoyeni et al., 2012) and *C. petiolata* leaves 6.82% (Omoyeni and Aluko, 2010). These values are also comparable to 9.6-10.8% reported for some indigenous leafy vegetables in Ebonyi State, Nigeria (Nnamani *et al,* 2009) but a little lower than 15.58-30.90% reported for some Nigerian leafy vegetables (Onwordi *et al*, 2009) and much more lower than 78.85-89.01% reported for some Cameroonian leafy vegetables (Ejoh *et al*, 2007). Though high moisture content of vegetables makes them to aid the digestion of food, however high moisture content also reduce the shelf life of vegetables because they facilitate bacterial and fungal action resulting into spoilage.

The crude fibre content of these vegetables ranged from 10.4%-21.15% with *Amaranthus dubius* having the lowest composition and *Solanum macrocarpon* having the highest composition, these values can be compared to 6.7-11.70% reported by Onwordi

et al (2009), 4.50-12.70% reported by Nnamani *et al* (2009) for some Nigerian leafy vegetables and 11.60% reported by Amata (2010) for *Myrianthus arboreus* leaves. Adequate intake of dietary fibre can lower serum cholesterol level, risk of coronary disease, hypertension, constipation, diabetes and breast cancer (Sizer and Whitney, 2003; Howe, 1981; Kraise and Mahan, 1984). This result showed that virtually all these selected vegetables have an appreciable level of fibre content and with *Solanum macrocarpon* having the highest composition of 21.15%. This score suggested that it can be recommended for patients with constipation/dyspepsia. Fibre is well known for maintaining bulk, motility and increasing peristalsis by surface extension of the food in the intestinal tract (Meyer, 2004; MCDonald *et al*, 1995; Sizer and Whitney, 2003). It is necessary for healthy condition, curing of nutritional disorders and for food digestion (Parge, 1988; Raijhan, 2001). The ash content is a measure of plants mineral contents. The ash content of the selected vegetables (leaves) ranged from 5.69-24.7% with *Ocimum gratissimum* having the lowest composition and *Basella alba* having the highest composition. This showed that the leaves contained appreciable amount of mineral elements. The values compared to 18.00% reported by Hassan and Umar (2006) for *Momordica balsamina* leaves and 16.4% reported for *Myrianthus arboreus* leaves (Amata, 2010). High ash content also suggested that they were rich in organic matter which is convertible to oxides and water on heating. The crude protein contents ranged from 12.19% to 26.33% with *Ocimum gratissimum* having the lowest composition while *Telfairia occidentalis* had the highest composition. This is comparable to the leaves of *Moringa oleifera* reported by Ashaolu and Omotayo (2007). This result showed that these selected vegetables are good sources of protein, with virtually all the leaves having an appreciable amount of it. Proteins in form of amino acids are nutrients needed by human body for growth and maintenance (Nelso and Cox, 2005; Lal, 2008; Garrett and Grisham, 2005). Protein is needed to form blood cells, protects, forms, rebuilds, maintains and grows tissue, skin, hair, muscle, connective tissue, bone marrow and

vital organs (Poleman and Capra, 1984; Kirschman, 1979; Lal, 2008). Protein deficiency can lead to reduced intelligence or mental retardation, while excess consumption of protein leads to a higher risk of kidney stone formation from calcium in the renal circulation (Kirshman, 1979; Lal, 2008).

The available carbohydrate which ranged from 4.72% to 56.50% with *Talinum fruticosum* having the lowest composition and *Ocimum gratissimum* having the highest composition. This result is comparable with that of Fagbohun *et al* (2012), which reported the range of 50.07% to 56.16% for three plants. Carbohydrate supply energy for nutrition and they are readily fermented by micro-organisms to yield carbon dioxide, alcohol, organic acids and other compounds (Sizer and Whitney, 2003). This result showed that the selected vegetables are good sources of carbohydrate because of their high composition of it in '*Ocimum gratissimum'*, thus this makes the latter a very good source of energy. The crude lipid or fat content ranged from 1.21% to 30.59% with *Amaranthus dubius* having the lowest composition and '*Talinum fructicosum*' having the highest composition. This result can be compared to the range of 6.81 to 7.28% of leaves of three plants reported by Fagbohun *et al*, (2012). It can also be compared to 8.3-22.0% reported in some vegetables consumed in Nigeria by Ifon and Bassir (1979). Many authors believe that leafy vegetables are poor sources of lipids. The consumption of these vegetables in large amount is a good dietary habit and may be recommended to individuals suffering from overweight and obesity.

The mineral analyses of these ten leafy vegetables are shown in Table 3. The highly soluble mineral elements: calcium (Ca), Magnessium (Mg), phosphorus (P), Iron (Fe), and potassium (K) help in the maintenance of acid-base balance of hydrogen ion concentration of the body (Vasudevan, 2005). They help to complete the absorption of vitamins, proteins, fat and carbohydrate of food. Calcium (Ca) and Iron (Fe) furnish all the cells and tissues of the body with the elements and the nutritional enzymes which they need. The higher calcium content of '*Cnidoscolus aconitifolius'* (63.38mg/100g) and

Vernonia amygdalina (32.52mg/100g) suggest that they would be advantageous to the body in the function associated with the mineral. Calcium with phosphorus is required for the formation of the bone and teeth and in the proper functioning of the nervous system. It had long been suggested that commonly consumed leafy vegetables are a superior source of calcium to milk (Kirschmann, 1979). Deficiency of calcium can lead to malformation of bones in young animals and formation of shelless eggs.

Magnesium (Mg) and potassium (K) are needed for acid base and electrolyte balance in the body. Almost all these selected vegetables with value ranging from 5.98mg/100g to 44.35mg/100g) with *Solanum macrocarpon* having the lowest composition and *Cnidoscolus aconitifolius* having the highest composition, they are therefore recommended for hypertensive patients. Since magnesium is useful in the reduction of blood pressure, magnesium is an obligate co-factor of DNA synthesis and the proportion supplied by green leafy vegetables can be used to supplement low magnesium based staple foods such as cassava in Nigeria. Magnesium deficiency may play a major role in some cases of anaemia. Deficiency of Magnesium has been shown to produce spasms of the coronary arteries and is thought to be a cause of non-exclusive heart attacks (Poleman and Capra, 1984; Kirschmann, 1979).

Phosphorus (P) is an important body mineral, it is important in the energy transfer of nucleic acids, its value ranged from 6.89mg/100g in *Basella alba* to 159.22mg/100g in *Cnidoscolus aconitifolius*. Phosphorus is the second most plentiful and essential mineral in the body and it is a key component of DNA/ RNA in the body. Besides, it works along with calcium to form bone and teeth and other essentials in the body. It plays an important role in the energy metabolism of the cells, affecting carbohydrate lipids (fatty acid) in the blood that also include cholesterol and triglyceride and protein, like calcium is essential for bone formation and maintenance (Kirschmann, 1979). Iron (Fe) is an essential component of haemoglobin. It was high in all the vegetables except for '*Ocimum gratissimum* with an amount which is low when

compared with the other vegetables such as *Talinum fruticosum* (39.2mg/100g), *Telfairia occidentalis* (87.96mg/100g), *Solanum macrocarpon* (40.13mg/100g), *Vernonia amygdalina* (46.97mg/100g), *Cnidoscolus aconitifolius* (54.45mg/100g), *Amaranthus cruentus* (97.27mg/100g), *Basella alba* (40.20mg/100g), *Amaranthus dubius* (95.21mg/100g), and *Corchorus olitorius* (27.25mg/100g). The relatively high concentration of iron (Fe) in *Telfairia occidentalis* may perhaps provide the basis for its use traditionally for boosting the blood content of the human body. Other trace elements like copper, manganese, and zinc are also present in appreciable amount except in cases like copper (Cu) which was almost lacking in '*Ocimum gratissimum*' and *Cnidoscolus aconitifolius* where a very low amount was observed.

However, it was different in others with the following values: 2.20mg/100g in *Talinum fruticosum*, *Telfairia occidentalis* (2.37mg/100g), *Solanum macrocarpon* (1.28mg/100g), *Vernonia amygdalina* (2.55mg/100g), *Amaranthus dubius* (3.94mg/100g), *Amaranthus cruentus* (3.95mg/100g) *Basella alba* (1.20mg/100g), and *Corchorus olitorius* (2.46mg/100g). Copper (Cu) helps to form haemoglobin in the blood facilitating the absorption and use of iron, so that the red blood cells can transport oxygen to tissues assisting in the regulation of blood pressure and heart rate, strengthening blood vessels, bones, tendons and nerves promoting fertility and ensuring normal skin and hair pigmentation. Cell respiration, aiding enzymes in digestion and energy metabolism, wound healing, in the liver ability to remove toxic substance, such as alcohol from the body, immune function and the regulation of heart rate and blood pressure (Nelson and Cox, 2005).

An adequate intake of zinc enhances the ability to promote healthy skin and hair. It also improves reproductive function (Nelson and Cox, 2005). Manganese is essential for the proper formation and maintenance of bone, cartilage and connective tissue, it contributes to the synthesis of proteins and genetic material and helps produce energy from foods except *Corchorus olitorius* which lacked manganese, *Cnidoscolus aconitifolius*

and *Ocimum gratissiumum* also showed very low amount. The values in others include: *Telfairia occidentalis* (36.55mg/100g), *Vernonia amygdalina* (43.68mg/100g), *Amaranthus cruentus* (4.35mg/100g), *Amaranthus dubius* (43.68mg/100g), *Basella alba* (5.88mg/100g), *Solanum macrocarpon* (4.96mg/100g), and *Talinum fruticosum* (12.54mg/100g) .

In conclusion, although these vegetables has been shown to be beneficial to both humans and animals. It is recommended that the leafy vegetables should not be taken solely as substitutes enough for foods but rather to support the major classes of food as they cannot meet all the required dietary allowances.

Table 1: Scientific names/Authors, Families, English, Local names of the ten vegetables used

S/N	Scientific Names & Authors	Family	English/Local Names
1	Amaranthus Cruentus. L.	Amaranthaceae	Eng: Green amaranth; Yor: Arowojeja
2	Amaranthus dubius. Maltex Thell	Amaranthaceae	Eng: Local amaranth, Yor: Efo tete, adayeba
3	Basella alba. L.	Basellaceae	Eng:Ceylon spinach, Yor: Amunututu
4	Cnidoscolus aconitifolius (Myeler) L.M. Johnston	Euphorbiaceae	Eng: Chaya; Yor: Iyanaipaja, Efo Bisobu
5	Corchorus olitorius	Taliaceae	Eng: Jute mallow, Yor: Oyoyo, Ewedu
6	Ocimum gratissimum L.	Lamiaceae	Eng:Tea bush, Yor: Native Basil, Yor: Efinrin
7	Solanum microcarpon L.	Solanaceae	Eng: Gboma vegetable, Yor: Igbagba, Igbo: Gboma- egg plant
8	Talinum fruticosum (L) Juss	Portulacaceae	Eng: Water leaf, Yor: Gbure, Odundun okun
9	Telfairia occadentalis Hook. F	Cuarbitaceae	Eng: Fluted pumpkin, Yor: Efo iroko, Ugu/Igwu Elegede
10	Vernonia amygdalina Del.	Asteraceae	Eng: Bitter leaf, Yor: Ewuro, Eriro, Ewuro/ Eriro jije.

Table 2: Proximate Composition of the Ten Vegetables

S/N	Samples	% Ash	%MC	%Fat	%Fibre	%CP	%CHO
1.	Amarathus cruentus	23.10	10.04	1.22	10.44	17.02	38.19
2.	Amaranthus dubius	22.11	10.03	1.21	10.40	17.05	37.20
3.	Basela alba	24.70	10.34	3.01	20.10	17.39	23.62
4.	Enidoscolus aconitifolius	12.23	17.03	15.33	11.46	17.19	26.77
5.	Corchorus olitorius	13.52	12.02	2.55	10.95	14.60	46.37
6.	Ocimum gratissimum	5.69	8.53	6.57	10.53	12.19	56.50
7.	Solanum macrocarpon	20.34	10.34	3.01	20.10	17.39	23.62
8.	Talinum fruticusum	19.37	17.32	30.59	11.51	16.49	4.72
9.	Telfairia occidenalis	11.20	10.90	7.55	13.23	26.33	30.80
10.	Vernonia amygdalina	15.48	10.96	5.95	11.50	21.60	34.52

Table 3: Mineral Composition of the Ten Vegetables(mg/100g)

S/N	Samples	Na	K	Ca	Mg	Zn	Fe	Cu	Mn	Fb	P
1	Amarathus cruentus	79.50	53.16	22.31	26.42	95.15	97.22	3.95	15.35	ND	31.36
2.	Amaranthus dubius	72.50	52.15	22.30	26.41	95.14	95.4	3.94	15.34	ND	30.35
3.	Basela alba	50.63	57.51	25.45	11.51	39.33	40.20	1.20	5.88	ND	6.89
4.	Enidoscolus aconitifolius	82.55	126.60	63.38	44.35	74.20	54.45	0.30	0.20	ND	159.22
5.	Corchorus olitorius	13.43	8.96	28.05	15.23	67.54	27.25	2.46	36.55	ND	11.54
6.	Ocimum gratissimum	9.72	27.79	14.09	9.92	4.47	2.55	-	0.45	ND	25.54
7.	Solanum macrocarpon	51.42	49.66	25.00	5.98	41.22	40.31	1.28	4.96	ND	8.75
8.	Talinum fruticosum	36.35	26.60	8.45	6.35	84.62	39.21	2.20	12.54	ND	15.35
9.	Telfairia occidenalis	34.55	24.96	18.32	11.38	102.31	87.96	2.37	36.55	ND	15.35
10.	Vernonia amygdalina	36.54	31.21	32.52	9.85	57.57	46.79	2.55	43.68	ND	14.58

REFERENCES

[1] AOAC, (2005): Official methods of Analysis of Association of Analytical Chemists. AOAC International, 18th ed; Horrowitz, W.(ed) vol 1 & 2, AOAC International Maryland, USA pp 774-784.

[2] Ashaolu, M.F. and Omotayo, F.O. (2007): Phytochemical, Nutritive and Anti-nutritive Composition of leaves of Moringa oleifera. Lom(Syn. Moringa petrygosperme. Getn(Moringaceae) Recent Progress in Medicinal Plants. Phytochemical Pharmacology 17:339-334.

[3] Burkill, H.M (1997): The useful plants of Tropical West African 3rd ed. Royal Botanical Garders, Kew pp1-652.

[4] Choadhury, B. (1977): Vegetables, National Book Trust, New Delhi. Pp 1-210.

[5] Dalziel, J.M. (1937): Useful Plants of West Tropical Africa. Crown Agents London pp1-650.

[6] Epenhaijsen, C.W. Van (1974): Growing Natives Vegetable in Nigeria, FAQ, Rome pp1-50.

[7] Fagbohun, E.D., Lawal, O.U and Ore, M.E.(2011): The proximate, Mineral and Phytochemical Analysis of the leaves of *Ocimum gratissilium* L. *Melanthera Scandens* (Schum & Thonn) Roberty and *Leea guiheensis* G. Don. International Journal of Applied Biology and Pharmaceutical Technology. Vol. 3; Issue 1. Pp15-22.

[8] Garrett, R.H. and C.M Grisham (2005): Biochemistry, 3rd ed. Thomson books/Cole, Belmont, USA pp1-1086.

[9] Grubben, G.H.J (1977): Tropical vegetables and their Genetic Resources, Internal Board for plant Genetic Resources F.A.O Rome.

[10] Howe, P.S (1981): Basic Nutrition in Health and Disease. 7th ed. W.B Saunders, Philadelphia/London pp1-566.

[11] Hutchinson, J., Dalziel, J.M. and R.W.J Keay (1954): Flora of West Tropical Africa. Vol. 1 part 1. Crown Agents London pp.136-155.

[12] Hutchinson, J.; Dalziel, J.M. and F.N. Hepper (1963): Flora of West Tropical African; Vol.2, Crown Agents, London. Pp 225-495.

[13] Ifon, E. T. and Bassir O. (1979): The Nutritive value of some Nigeria leafy green vegetables. Part 1 Vitamins and Minerals content. Food Chemistry 5:263-267.

[14] Kirshmann, J.D. (1979): Nutrition 1st ed. Macmillan International, London/New York, pp. 1-425.

[15] Kocchar, S.L. (2009): Economic Botany 3rd ed. Macmillan Publishers-India Lad, New Delhi pp1-295.

[16] Krausse, C. and L. Mahan (1984): Food, Nutrition and Diet therapy. A textbook of Nutritional care 7th ed. W.B. Samndere company, London pp1-955.

[17] Lal, H. (2008): A textbook of Biochemistry, 1st ed. , 2nd reprint, CBS Publishers and distributors New Delhi, pp1-497.

[18] Martin, F.W. and L. Telek (1979): Vegetables for the Hot, Humid Tropics, part 6, A Maranth and Celosia U.S. Department of Agriculture, New Orleaanns, pp.112-150.

[19] Math, P.(1976): Vegetable for the Tropical Region, ICAR Book Series No 2, Indian Council for Agricultural Research, New Delhi pp1-210.

[20] McDonald, P.; Edwards, R.A.; Greenhalph, J.F.D and C.A. Morgan (1995): Animal Nutrition 5th ed. Longman/Pearson Educ, Ltd, Essex, UK pp1-607.

[21] Meyer, L.H. (2004): Food Chemistry, 2nd ed. CBS Publishers, New Delhi pp1-385.

[22] Nelson, D.L. and M.E. Cox (2005): Lehninger principles of Biochemstry 4th ed. Palpigraph Macmillan Company, New York/Basinstoke pp1-1119.

[23] Nielson, S.S. (2005): Introduction to Chemical Analysis of foods, 2nd ed; Reprinted; CBS Publishers New Delhi, pp1-530.

[24] Ochse, J.J and R.E. Van den Brink Bakhuizen (1980): Vegetables of the Dutch East Indices, Asher; Amsterdam; pp-1-150.

[25] Oguntona, T. (1998): Green Leafy Vegetable in Osagie, A.U. Eka, O.U. (eds): Nutritional Quality of Plant Foods. Post Harvest Research Unit, University of Benin, Benin City, pp120-133.

[26] Omoyeni, O.A.and B.T. Aluko (2010): Qualitative Determination of Chemical and Nutritional Composition of Cissus petiolata leaves. Electronic Journal of Environmental, Agricultural and Food Chemistry 9:436-440.

[27] Omoyeni, O.A., E. Aterigbade, R.O. Akinyeye and R.A. Olowu (2012): Phytochemical Screening, Nutritional/Anti-nutritional and Amino acid compositions of Nigeria Melanthera Scandens. Scientific Reviews & Chemical Communications 2:20-30.

[28] Omotayo, F.O. (1997): Plants of South Western Nigeria (Yorubaland).

[29] Omotayo, F.O. (2001): Ethnobotany-Plants in Yoruba Belief and Culture. Herbarium Unit, Dept of Plant Science (Botany) Faculty of Science, Ekiti State University, Ado-Ekiti.

[30] Oomen, H.A.P.C. and G.H.J Grubben (1977): Tropical Leafy vegetables in Human Nutrition, Communication, 69, Dept of Agricultural Research, Roayl tropical Institutes, Amsterdam pp1-20.

[31] Pandey, B.P. (2010): Economics Botany 7th Revised ed; 3rd Reprint S. Chand and Company Ltd; New Delhi, pp1-628.

[32] Parge, O.M. (1988): Clinical Nutrition 2nd ed. The C.V. Mosby Company, St. Louis, USA pp1-937.

[33] Poleman, C.M. and C.L. Capral (1984): Nutrition Essential and Diet. Therapy W.B. Saunders company, Philadelphia/London/Toronto pp1-359.

[34] Pomeranz, Y. and C.E. Meloan (2004): Food Analysis 1st Indian ed; 7th Reprint, Chapman and Hall Inc. CBS Publishers and Distributors. New York/New Delhi. Pp 1-778.

[35] Potters, W.N. (2003): Food Science 5th ed; CBS Publishers and Distributors, New Delhi, pp1-540.

[36] Purseglove, J.W. (1968): Tropical Crops – Dicotyledons, Longman Harlow/London, pp1-640.

[37] Ranjham, S.K. (2001): Animal Nutrition: 5th Revised edition. Vikas Publishing House Pvt Ltd, New Delhi, pp1-576.

[38] Schippers, R.R. (2000): African Indigenous vegetables. And overview of the cultivated species NRI/ACP-EU Technical centre for Agricultural and Rural Co-operation, Chatham UK pp1-214.

[39] Sizer, F. and E. Whitney (2003): Nutrition Concepts and Controversy 9th ed. Thomson and Wadsworth, Belmont, USA pp1-350.

[40] Tindall, H.D. (1983): Vegetables in the Tropics, 1st ed, 2nd Reprint. Macmillan/ELBS, Hampshire, pp1-533.

[41] Vasudevan, D.M. and S. Sreekumari (2007): Textbook of Biochemical for medical students, 5th ed, Jaypee Brothers Medical Publishers New Delhi, pp.1-535.

[42] Wong, D.W.S. (2005): Mechanism and Theory in food Chemistry, 4th ed; CBS publishers and Distributors, New Delhi, pp1-550.