African Journal of Biotechnology Vol. 11(79), pp. 14468-144573, 2 October, 2012
Available online at http://www.academicjournals.org/AJB
DOI: 10.5897/AJB12.1088
ISSN 1684–5315 ©2012 Academic Journals

Full Length Research Paper

Spices and food condiments in Niger-Delta region of Nigeria

Green B. O.[1], Nworgu F. C.[2]* and Obazee M. N.[1]

[1]Department Forestry and Environment, River State University of Science and Technology, Port Harcourt, River State, Nigeria.
[2]Federal College of Animal Health and Production Technology, Institute of Agricultural Research and Training Moor Plantation, PMB 5029 Ibadan, Oyo State, Nigeria.

Accepted 5 September, 2012

Spices and food condiments studies here have both local and international values and recognition. Forty seven crop species commonly used as spices and condiments in the rainforest ecosystem of the Niger delta region of Nigeria were evaluated. The study revealed that leafy vegetables are richer in crude protein (CP) than the spices and bulb. However, all these crops are rich in minerals, relatively low in crude fibre (CF), phylate, oxalate and tannin. Hence they need to form part of our daily diet. *Gongronema latiffora* had the highest concentration of CP (34.07%) and ash (15.50%), while the least was *Allium cepa* with 1.55% CP and 0.60% ash. Calcium (Ca), phosphorus (P), sodium (Na) and iron (Fe) were the most available minerals. These crops are natural and contain mainly minerals and vitamins and sometimes stimulants and protein which are curative. Herbal medical practitioners are always in love with these plants because they add value to life when properly used and bring income to the farmers that cultivate them. There is need to intensify the cultivation of these crop species in all parts of Nigeria where they grow very well.

Key words: Spices, food condiments, Niger Delta.

INTRODUCTION

Spices and food condiments have remarkable history. They played prominent roles in the civilization of antiquities like China, India, Babylon, Egypt, Greek and Rome. Many spices had their origins in the Asiantic tropics (Simpson and Ogorzally, 1995). The first group of traders were the Arabs who brought spices from Asia to their homes and then Europe. The colonial and trade ventures further spread the products. From the 16th Century, the Portuguese had spice monopoly for at least two years before it was infiltrated by the Dutch, British and Holland. Today, spices and food condiments marketing has become a world trade (Health, 1981; Lewington, 1990).

Spices and food condiments are linked historically, chemically and their physiological effects on human bodies (Consumers Report, 1993). The significance or use of spices started initially when offerings made to gods were burnt together with spices. It was assumed that as the scent went up and perceived by devotes, the gods were also receiving the offerings (Morris, 1984; Muller and Lamparsky, 1991). Also, mummified bodies were prepared with lots of spices helping them last for posterity. Spices and food condiments are helpful in food garnishing and as appetizers. They add more values to foods. Infact, those who have never thought of going into catering are attached by the flavours and aromas they emit. Most chemicals responsible for those distinctive taste and smell are compounds known as essential oils or volatile oils (diffusing readily into the air). Essential oils can be produced in any part of the plant either as an excretion (by-product of metabolism or metabolic waste) or secretion, deliberately synthesized for a purpose. At times, this may be a way of protecting the plants. These

*Corresponding author. E-mail: fcnworgu@yahoo.com or fcnworgu@gmail.com.

oils can deter the growth of competing plants (allelopathic effect) or repel predators (Vasey, 1992; Ody, 1993; Sauer, 1993).

Some world spices include basils (*Ocimum* spp), Peppers (*Capsicum* spp), ginger (*Zingiber* spp), coriander (*Coriandrum* spp), thyme (*Thymus* spp), nutmog (*Myristica* spp), peppermint (*Mentha* spp), rosemary (*Rosmarinus* spp) and vanilla (*Vanilla* spp). Isawumi (1981) reported 123 edible fruits in Nigeria out of which 7 are peppery. Food condiments in Nigeria are open-ended and difficult to list. This is because certain plants and plants parts, which are thought to be poisonous may carefully be used in a particular clan. For instance, leaves of *Manihot esculenta* and *M. glazovil* are used as soup vegetable after certain pretreatment to remove some quantity of cyanide in parts of Abia State of Nigeria and in Sierra Leone.

Man continues to consume and utilize a variety of vegetable in form of leaves, roots, bulbs, seed and fruits. Vegetables are known to man to be important in the supply of minerals, vitamins, certain hormone precursors, protein and energy (Oyenuga and Fetuga, 1975; Nworgu et al., 2007). The bioavailability of these essential nutrients could be reduced by the presence of some anti-nutrients (Nwokolo and Bragg, 1977; Lewis and Fenwick, 1987; Nworgu, 2004). In orde to obtain optimal health benefits from vegetables and spices, it is suggested that man should consume a balanced diet with a wide variety of phytochemical sources (Lui, 2002).

However due to climate change, nutritional profiles of the spices and food condiments tend to change considerably, hence the need for re-evaluation. Nworgu et al. (2012) reported that *Ocimum gratissimum* leaves had low crude protein content (6.38%) and high crude fibre (18.52%) and ash (12.24%). The authors aim at highlighting local spices in Nigeria (especially those in the rainforest ecosystem) and their ethnobotanical implications for health and healthy living and their nutritional values.

MATERIALS AND METHODS

All the plants under study were collected within the rainforest ecosystem of Nigeria. Others very often used within the ecological zone, but endemic to Savannah ecosystems were also collected (Table 1). The vegetables and spices used were rinsed with water and the edible portions separated. The edible portions (leaves, fruits and bulbs) were chopped into smaller pieces and sun-dried to moisture content of 12 to 13% prior to analysis.

The proximate compistion ot some of the vegetables and spices was determined by Association of Official Analytical Chemists (AOAC, 1990*)* methods. Protein (N × 6.25) content was determined using the micro-Kjedhal method. The minerals (Fe, Zn, Mg, Ca and P) were determined using of the solution of ash by the flame atomic spectrophotometric procedure (Boehringer, 1979) using atomic absorption spectrophotometer (model 372), while K and Na were determined by flame photometer. Phylate was determined by the procedure of Igbedion et al. (1994), tannin by the method of Hagerman and Ler (1983) and oxalate by the technique of Talapatra and Price (1984).

RESULTS AND DISCUSSION

Out of forty-seven plant species understudied, nineteen were spicy and peppery. Twenty-seven taxa are food condiments and vegetables. The importance of spices and peppery fruits has been emphasized by Isawumi (1981). These spices are also medicinal and have alkaloid, glycosides and saponins. Though the communal people noticed these spices by trial and error, their food and medicinal values are enormous. This is also in line with the findings of Lewington (1990) who reported the enormous medical values of many peppery fruits like *Capsicum* spp. According to this finding, *Capsicum* species contain cayeines, which are carminative and digestive stimulants (Table 1). Food condiments are usually soup thickners or vegetables that contain minerals and vitamins. This agreed with the report of Ody (1993) and who opined that vegetables and fruits have minerals and vitamins, which supplements the losses during ill-health.

The leafy vegetables analysed were rich in crude protein (CP) (14.97 to 34.07%) except *Solanum macrocarpon* (6.38%). The leafy vegetables had higher concentration of CP, crude fibre (CF) and ash than the spices (Table 2). The CP and CF reported here for *Talinum triangulare* are similar to the submission of Oyenuga (1968) (21.09 and 10.34%) and Taiwo (1998) (21.16 and 11.34%), respectively. However, Oyenuga (1968) reported total ash of 34.56%, while Akindahunsi and Salawu (2005) reported CP, CF and ash of 31.00, 6.20 and 20.00%, respectively. The CP of *Telfairia occidentalis* leaves in the present study is similar to the report of Okoli and Mgbeogba (1993) (23.50%) but lower than the values reported of Ladeji et al. (1995) (30.50%), Akwaowo et al*.* (2000) (39.40%), Schippers (2000) (29.40%) and Fasuyi (2007) (35.14%). The CF in this study is lower than the value reported by Fasuyi (2007) (12.68%), but the ash in both studies are similar, 10.87% for Fasuyi (2007).

The CP, CF and ether extract (EE) of *Solanum macrocarpon* reported in the present study are slightly higher than what was obtained by Tindal (1986) and Schippers (2000) whose values were 4.6, 1.6 and 1.0%, respectively. Akindahunsi and Salamu (2005) reported EE, CF and ash of 8.10, 6.60 and 12.00% for *S. macrocarpon,* respectively.

The value of CP and EE for *Vernonia amygdalina* reported here are lower than the submission of Akindahunsi and Salawu (2005) whose values were 32.05 and 12.73%, respectively, but the ash and CF compared favourably with the reports of the aforementioned authors whose values were 12.00 and 6.50%, correspondingly. Akindahunsi and Salawu (2005) reported CP of 29.78% and EF of 11.47% for *Piper giuneese* which is in agreement with the values reported here unlike CF of 6.40% and ash of 16.00% which were higher than in the present study. The values of CP, CF and EE reported in this study for *Capsicum frutescens*

Table 1. Plate taxa under study, common names, families, localities and ethnobotanical significance.

Common name	Plant taxa	Families	Localities	Enthnobotanilcal significance
Okra	*Abelmoschus esculentus*	Malvaceae	Agric. Farm UST	Soup condiment
Alligator pepper	*Aframomum melegueta*	Zingiberaceae	Anadu close, Rumuomasi, Port Harcourt	Chewed against throat irritation and aids blood circulation
Onions	*Allium cepa*	Liliaceae	Mini botanical	Release of gas, throat infection
Garlic	*Allium sativa*	Liliaceae	Garden COE	Blood purifier, fibroid Prevention
Achi (Igbo)	*Brachytegia nigeria*	Caesalpiniaceae	Azima town, Abia State	Soup condeiment and thicker
Cabbage	*Brassica olearecea*	Brassicaceae	Nguru town	OCndiment for fried rice
Hot small pepper	*Capsicum frutescens*	Solanaceae	Runuji town River State	Peppery spice with caycine
Sweet big pepper	*Capsicum annum*	Solanaceae	Rumuolemeni farmland	Peppery spice with caycine
Sweet pepper	*Capsicum chinense*	Solanaceae	Makurdi, Benue State	Garnishing fried rice with caycine
Yellow curry	*Coriandium sativum*	Apiaceae	Asian tropics	For spicing stew
Cucumber	*Cucumis sativus*	Cucurbiataceae	Nguru town	Garnishing fried rice
Ewedu (Yoruba)	*Corchorus olitorius*	Tiliaceae	Rumuji farmland	Soup condiments vegetable
Egusi/Melon	*Colocynthus vulgaris*	Cucurbitacea	Rumuolumeni farmland	Soup thicker
Carrot	*Daucus carota*	Apiaceae	Nguru town	Garnishing fried rice
Offor (Igbo)	*Ditarium microcarpon*	Caesalpiniaceae	Aziama village square	Soup thicker
Pepper fruit	*Dennetia tripetala*	Annonaceae	Rumuji farmland	Pepper fruit
Palm fruit	*Elaeis guineensis*	Arecaceae	Amadi close, Port Harcourt	Soup thicker/oil producer
Utazi (Igbo)	*Gongronema latiffora*	Asclepidiaceae	Rumuji forest	Bitter taste vegetable
Okazi (Igbo)	*Gnetum africanum*	Gnetaceae	Emuoha town	Soup vegetable
Soybeans	*Glycime max var. soja*	Paiplinaceae	Elekahia farm	Soup thicker. Used for stew as well
Ogbonno (Igbo)	*Irvinga gabonnesis*	Irvinjaccaceae	Choba bush	Soup thicker
Lettuce	*Lactuca sativa*	Brassicaceae	Nguru town	Garnishing fried rice
Tomatoes	*Lycopersicum esculentum*	Solaneceae	Choba farmland	Stew thicker
Ukpo	*Mucuna solanei*	Caesalpiniacea	Rumuji forest	Soup thicker/condiment
African nutmeg	*Monodora myristica*	Annonaceae	Oturugbo town	For cake and pastries
Scent leaf	*Ocimum gratussimum*	Lamiaceae	Elekaia farmland	Pepper soup spice for stomach ache
Curry leaf	*Ocimum virdis*	Limiaxeae	Elekaia farmland	For spicing stew
Uziza (Igbo)	*Piper nigrum/P guineanes*	Anoraceae	Rumuolumeni	For Africa salad and soup
Oil bean	*Pentclethra macrophylla*	Mimosaceae	Elekahia estate	For seeds added to pap
Avocado pear	*Persea amaricana*	Lauraceae	UST compound	For soup
Achara	*Pennisetun purpurem*	Poaceae	India	As stew and rice spice & soup
Rosemary	*Rosmarinus afficinalis*	Lamiaceae	Elekaia farmland	For stew
Garden egg	*Solanum incanum*	Solanaceae	Elekaia farmland	For yam and stew
Mail garden egg	*S. nigrum*	Solanaceae	Benue State	For fried rice/laxative
Egg plant	*S. melongena*	Solanaceae	Benue State	For fried rice/laxative
Irish potato	*Salanum tuberosum*	Solanaceae	Elekaia village	For stew/soup/laxative

Table 1. Contd.

Spinach	*Spinacia oleracea*	Chrnopodiace	Elekaia village	For stew/soup
Uniokirihio (Igbo)	*Tetrapleura tetrptera*	Mimosacea	Eziama forest, Abia	As spice for pepper soup
Fluted pumpkin	*Telfiaria occidentalis*	Cucurbitaceae	Elekaia farmland	Soup vegetable and blood tonic
Snake tomatoes	*Trichosanthes cucumerina*	Cucurbitaceae	Choba farmland	Stew condiment
Thyme	*Thymus vulgaris*	Laminaceae	Jos	Stew spice
Vanilla	*Vanitta fragrants*	Orchidiaceae	Jos	Spice for cake
Uda	*Xylopia aethiopica*	Annonaceae	Ibaa forest	Spice for pepper soup
Genger	*Zingiber officinale*	Zingiberaceae	COE campus Iwote	Stew and rice spice

Green (2006); UST = University of Science and technology. COE = College of Education.

Table 2. Proximate composition of some of the tropical green vegetables and spices (% Dry Matter).

Vegetables and spices	Crude protein	Crude fibre	Ether extract	Ash	Nitrogen free extract
Talinum triangulare	19.89	8.10	3.85	10.00	58.16
Telfiaria occidentalis	21.31	6.41	5.50	10.92	55.56
Solanum macrocarpon	6.38	5.37	1.42	3.89	82.94
Vernonia amygdalina	21.68	10.00	2.80	10.00	55.52
Gnetum africanum	14.97	34.00	7.44	6.00	37.59
Gongronema latiffora	34.07	8.75	13.80	15.50	27.88
Piper nigrun	33.04	3.05	14.00	7.50	42.41
Occimum gratissimum	6.38	18.52	5.89	12.24	48.94
Allium saliva	20.59	6.60	8.34	18.00	46.38
Allium cepa	1.55	0.50	0.60	0.60	96.75
Zingiber officinale	2.06	2.50	0.80	0.75	93.89
Capsicum frutescens	2.17	1.00	0.61	0.80	95.42

are lower than the submission of Tindall (1986) whose figures were 4.1, 6.0 and 2.3% respectively. The CP, CF and EE for *Allium sativum* in the present study are similar to the results of Tindall (1986) whose values were 7.0, 1.1 and 0.3%, respectively. Similar observation was made on *Allium cepa* whose CP and CF were 1.5 and 1.0%, correspondingly. The concentrations of CP and ash for *V. amygdalina* in this study are slightly lower than the values reported by Fube and Djonga (1987), which were 24.94 and 16.60% for CP and ash, respectively. Okafor (1995) reported CP of 10.18% which is similar to the present study and ash of 10.18% for *Gnetum africanum*, which are similar to the present study. Variations in the aforementioned spices and vegetables with references to their CP, CF, EE and ash could be attributed to the age of harvesting, ecological zone, season of planting and harvesting, agronomic practices adopted, methods of processing and analyses.

Akindahunsi and Salawu (2005) reported that low levels of phytic acid, tannic acid and oxalate in the vegetables and spices coupled with high level

Table 3. Chemical composition of some of the tropical green vegetables and spices (% Dry Matter).

Vegetables and spices	Ca	P	Na	K	Mg	Zn (mg/100 gDM)	Fe (mg/100 gDM)	Mn (mg/100 gDM)	Phylate (mg/100 gDM)	Tannin (mg/100 gDM)	Oxalate (mg/1000 gDM)
Talinum triangulare	1.39	0.39	0.39	1.50	0.47	15.00	1.00	-	0.41	3.85	0.03
Telfiaria occidentalis	0.67	0.04	0.26	0.15	0.43	7.20	18.50	1.12	0.04	0.184	0.004
Solanum macrocarpon	0.04	0.04	0.35	0.41	-	-	12.00	550	0.73	0.21	0.35
Occimum gratissimum	7.02	0.24	0.06	0.09	0.50	139.04	282.00	33.12	-	-	-
Vernonia amygdalina	1.08	0.85	0.03	-	-	-	30.00	-	-	-	-
Gnetum africanum	0.13	0.36	0.17	-	-	-	40.00	-	-	-	-
Gongronema latiffora	1.35	0.34	0.17	-	-	-	90.00	-	-	-	-
Piper nigrun	2.08	0.41	0.07	-	-	-	105	-	-	-	-
Allium saliva	3.20	0.21	0.25	-	-	-	1050	-	-	-	-
Allium cepa	4.00	0.22	1.15	-	-	-	30	-	-	-	-
Zingiber officinale	2.00	0.41	4.50	-	-	-	250	-	-	-	-
Capsicum frutescens	2.00	0.53	3.16	-	-	-	650	-	-	-	-

of zinc bioavailability indicating that these crops are good dietary supplement. However, the concentrations of zinc and iron in this study for *T. triangulare*, *T. occidentalis* and *S. macrocarpon* are lower than the submission of the aforementioned authors unlike the concentrations of phylate, tannin and oxlate, which were very low and similar (Table 3). The concentration of potassium (0.59%) reported by Ladeji et al. (1995) and calcium (0.40%) according to Ifon and Basir (1980) for *T. occidentalis* are in agreement with the present report. Ladeji et al. (1995) reported 1.20 mg/100 gDM for iron in *T. occidentalis*, which is lower than in the present study (18.5 mg/100 gDM). Okugie and Ossom (1983) reported that *T. occidentalis* leaves harvested at 16 weeks after planting contained 0.47% phosphorus and 1.36% potassium. The authors report on potassium is higher than in this study. Calcium content of *T. traingulare* in the present study is slightly higher than the report of FAO, (1968) (1.2%), while the author's report for phosphorus (0.67%) is higher than in the present study. Akindahunsi and Salawu (2005) reported 1.35, 1.41, 1.62, 3, 34 and 0.11% for Mg, Na, K, P and Ca, responsibility for *S. macroarpon* and these are higher that the present study. The concentration of K in this study (1.50%) is similar to the value of these authors (1.65%) for *T. triangulare*. The concentration of P for *P. nigrum* in this study is lower than the reports of Akindahunsi and Salawu (2005) (2.00%). The values of P for *A. sativa* reported here is similar to the result of Tindall (1986) (0.26%). However, the concentrations of Ca for *A. sativa* and *A. cepa* in this study are higher. The concentrations of Ca and P for *C. frutescens* reported here are lower than that of Tindal (1986) whose values were 0.58 and 1.01% for Ca and P, respectively. The values of Ca (0.28%), Na (0.26%) and Fe (52.30 mg/100 gDM) reported by Okafor (1995) for *G. africanum* are higher than the values reported here. Variations in the minerals of the vegetables and spices in comparison with other authors could be due to age cutting, methods analyses, geographical zones, cultural practices adopted and seasons. These crops are rich in minerals and low in phylate, oxalate and tannin and need to form part of our daily diets for healthy living.

The medicinal values of some of these vegetables and spices are associated with their high crude fibre contents and very good profile of mineral elements. Hence, *V. amygadlina, O. gratissimum, S. macrocarpum* are very useful for diabetic patients and those who want to loose weight, while *T. triangulare* and *T. occidentalis* are used for anaemic patients.

Conclusion

The studied vegetables and spices are readily available in rainforest ecosystem in Niger Delta of Nigeria. They form daily vegetables and spices of the indigens of the zone. The vegetables were rich in CP (14.97 to 34.07%), except *S. macrocarpon* (6.38%) and *A. cepa* (1.55%). Most

available minerals were Ca, P, Na, K and Fe.

REFERENCES

Akindahunsi AA, Salawu SO (2005). Phytochemical screening and nutrient-antinutrient composition of selected tropical green leafy vegetables. Afr. J. Biotech. 4(6):497-501.

Akwaowo EU, Ndon BA, Etuk EU (2000). Minerals and anti-nutrition in fluted pumpkin (*Telfaria occidentialis* Hook F.). Food Chem. 70:235-240.

AOAC (1990). Association of Official Anatical Chemists. Official Methods of analysis. 15th ed. Washington DC pp.45-56.

Boehringer (1979). Boehringer Mannhel GmbH Diagnostic 6800 Mannheim 31, Germany. Cat. No.124974.

Consumers Reports (1993). How to buy a fragrance. Consumer Report. Dec. 58(12):765-775.

FAO (1968). Food comspoition table for use in Africa. FAO and US Department of health, education and Welfare, Bethesda, Maryland.

Fasuyi AO (2007). Effect of graded levels of fluted pumpkin (*Telfaria occidentalis*) leaf meal on the nutrition, biochermistry and haematology of broiler finisher. Agric. Sci. Res. J. 1(1):5-12.

Fube HN, Djonga B (1987). Tropic vegetable in human nutrition: A case study of ndole bitter leaf (*Vernonia calvoana Hook*). Acta-Horticultureae 198:199-205.

Green BO (2006). Taxonomic checklist of indigenous ethnobotanical plants in Niger – Delta. In: Ethnoscience in Africulture for sustainable food production and livelihood Nworgu FC and Olakojo SA (ed), Bora-Agro Ventures IAR&T Ibadan 1st ed. pp.1-7.

Hagerman AE, Ler IG (1983). Precipitation methods for the quantitative determination of tannis. J. Agric. Food Chem. 26:809-812.

Health HB (1981). Source book of flavours. Weot Port CT AIV. Oxford University Press, New York pp.30-58.

Ifon ET, Basir O (1980). The nutritive value of some Nigerian leafy vegetables, particularly vitamin and mineral contents. Food Chem. 4:263-267

Igbedion SO, Olugbemi KT, Akpapunam MA (1994). Effect of procession methods on phytic acid level in bambara nut and pea. Food Chem. 50:147-151.

Isawumi MA (1981). Three supersweet fruits of Nigeria. Niger FLD 46:65-70.

Ladeji CT, Okoye ZSC, Ojobe T (1995). Chemical evaluation of nutritive values of fluted pumpkin (*T. occidentalis*) leaf. Food Chem. 53:353-355.

Lewington AA (1990). Plant for people. Oxford University Press, New York pp.90-95.

Lewis HM, Fenwick GR (1987). Glucosinolate content of Brassica vegetables: Analysis of twenty-four cultivators. Food Chem. 25:259-268.

Lui RH (2002). Supplement quick fix fails to deliver. Food Technol. Int. 1:71-72

Morris ET (1984). Fragrance: The Story of perfume from Cleopatra to Channel. New York Scriber pp.40-77.

Muller PM, Lamparsky (1991). Perfumes: Arts science and technology. London, Elsevier Publ. pp.22-40.

Nwokolo EN, Bragg DB (1977). Influence of phytic acid and crude fibre on the availability of minerals from four protein supplements in growing chicks. Can. J. Amin. Sci. 57:475-477.

Nworgu FC (2004). Utilization of forage meal supplements in broilers production Ph.D Thesis. University of Ibadan, Nigeria pp.190-205.

Nworgu FC, Ogungbenro SA, Solesi KS (2007). Performance and some blood chemistry indicies of broiler chicken served thifted pumpkin *Telfairia occidentalis* leaves extent supplement: America-Euraasian J. Agric. Environ. Sci. (3):90-98.

Nworgu FC, Oduola OA, Alikwe PC, Ojo SJ (2012). Effect of basil (Ocimum gratissimum) leaf supplement on initiation of egg laying and egg quality parameters of laying hens. J. Food Agric. Environ. 10(2):337-342.

Ody P (1993). The complete medical herbal, London. Dorling Kingdersley pp.21-30.

Okafor JC (1995). Conservation and use of traditional vegetables from woody forest species in Southeastern Nigeria. Proc. of IPGRI workshop on genetic resources of traditional vegetables in Africa. August 1995. Nairobi.

Okoli BE, Mgbeogba CM (1983). Fluted pumpkin (*Telfairia occidentialis*). West African Vegetable Crop Econ. Bot. 37(2):145-149.

Okugie DN, Ossom EM (1983). Effects of mulch on the yield, nutrient concentration and weed infestation of fluted pumpkin (*Telfairia Occidentialis* Hokks). Trop. Agric. Trinidad. 55(3):202-204.

Oyenuga VA (1968). Nigeria's food and feeding stuffs: Their chemistry and nutrive values. 3rd ed. Ibadan University Press. University of Ibadan, Ibadan Nigeria pp.35-40.

Oyenuga VA, Fetuga BL (1975). First Nation seminar on fruits and vetgetables. Proc. NIHORT and recommendations in Ibadan, Nigeria.

Sauer JD (1993). Historical geography of crop plant. A selected roster. Boca Ration FLCRC Press pp.30-50.

Schippers RR (2000). African indigenous vegetables: AN overview of the cultivated species. CTA DFID and NRI. Greenwich London. 1st ed. pp.66-147.

Simpson BB, Ogorzally MC (1995). Origin of crops and vegetables. New York. MC Group Hill pp.5-307.

Taiwo AA (1998). Proximate and chemical composition to some Nigerian underutilized non-conventional feed resources. Annual in – House Rev. of IAR&T. held on 10–12th Feb 1998. pp.10-11.

Talapatra EE, Price BE (1984). Oxalate: Its chemistry and nutritional significance. World Rev. of Nutrition and Dietetics. Kragen, New York. pp.100-121.

Tindall HD (1986). Vegetables in the tropics. Low prices. ELBS/Macmillan. 2nd ed pp.184-345.

Vasey DE (1992). An ecological history of agriculture. 10, 000BC, AD 10000 Amens Lowa State University Press pp.2-78.