**THE ROLE OF INDIGENOUS VEGETABLES IN FOOD SECURITY AND ECONOMIC GROWTH IN NIGERIA: A REVIEW**

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**ABSTRACT**

Over the past two decades, Sub-Sahara Africa (SSA) is the only region of the world where per capita food production has steadily declined. Nowhere in the word are the linkages between agriculture and poverty strongest than in Africa, specifically SSA. Global agricultural abuses and mismanagement are the primary causes of poverty. Unfavorable farming policies and declining investment in agricultural research are partly responsible for the low food production output in Nigeria. The World Health Organization reported that chronic under-nutrition affects over 200 million people accounting for over 42% of the population of Sub-Sahara Africa. Indigenous vegetables represent inexpensive but high quality nutritional sources especially for the poor segment of the population of Nigeria. Several literatures have documented the nutritional, medicinal and economic values of indigenous vegetable species. Vegetables have been found to be of high economic importance to rural dwellers where their sales generate a high level of income thereby reducing poverty. Further study More researches need to be carried out to document severely underutilized vegetable species in every part of Nigeria to provide an up-to-date database. An estimate of about 1000 plant species in sub-Saharan Africa are said to be leafy vegetables and if these species continue to be neglected and underappreciated, knowledge about them may be lost unavailable to the upcoming generation and leading to their extinction.

**KEYWORDS:** Economic growth, Extinction, Food security Indigenous vegetables, Poverty.

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**INTRODUCTION**

Vegetables are herbaceous plants whose parts are consumed in diets as supporting food or main dishes and may be aromatic, bitter or tasteless (Rahal and Kumar, 2009). Parts of vegetables usually consumed include but not limited to leaves, stem barks, roots, tubers, flowers, seeds and bulbs. They are cheap sources of important classes of food necessary for proper growth and development. Indigenous vegetables are plant species that are important for sustainability of economies, human nutrition and health, and social systems but are yet to attain global recognition as major vegetable commodities (Keatinge *et al.,* 2015). Guarino, (1997) also defined indigenous leafy vegetables as vegetables of a locality which originated from an area and may or may not be confined to that particular region. Vegetables have proven nutritive value in terms of having high carbohydrate, protein, vitamins and minerals in comparison to that of exotic vegetables (Rahal *et al*., 2014). It is therefore important to note the importance of these ready food sources in daily diets especially in poverty stricken countries of the world. Several studies have emphasized that approximately half of the leafy vegetables consumed are from wild plants constituting significant micronutrient sources especially in times of drought and famine (Grivetti and Ogle, 2000; Lockett *et al.*, 2000) and this is prevalent among the low income rural dwellers.

Agricultural fields, home and school gardens are sources from which vegetables can be obtained. Indigenous vegetables have now become underutilized due to the prevalence of the exotic species such as spinach, cabbage, kale and tomato which are widely cultivated all over the world. Inadequate documented scientific information on indigenous African vegetable species is a major factor that influences people to choose exotic vegetables over indigenous types. In addition, promoting consumption of indigenous green leafy vegetables among people is a key to improving the health of many (Olujobi, 2015). The world’s population which is estimated to be about 7.2 billion is expected to increase to about 9.6 billion by the year 2050 and much of this growth is may be concentrated in poor third world countries (DESA, 2013)., Suitable land area for agricultural productivity is gradually declining and competition for available space increasing, this can be attributed to human population growth and rapid urbanization. The increase in population will be accompanied by a concurrent increase in food demand, and this may result in food insecurity if the increase is not met. Most importantly, knowledge of indigenous plant use needs urgent scientific investigation and documentation before it is irretrievably lost to future generations (Guarino, 1997)

The most recent definition of food security was coined at the 2006 World Food Summit: as*‘a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life’* (FAO, 2009). According to FAO (2009), in tackling food security, four aspects are often considered, viz, food availability, access, utilization and stability. Capone *et al.* (2013) elaborated on three of the elements which involves production, distribution and exchange (food availability), affordability, allocation, and preference (food accessibility) and nutritional, social and food safety values(utilisation).The menace of food insecurity recently ongoing in Nigeria was delineated by the study carried out by the International Institute of Tropical Agriculture (IITA) in the year 2012. The study in conjunction with the Global Food Security Index (GFSI) of the Economic Intelligence Unit carefully examined the dimension of food insecurity experienced presently in Nigeria. The study revealed that ranked Nigeria very high in terms of food availability or supply among many other countries. However, in the area of food affordability or food access, Nigeria was ranked very low. In fact, out of a total of 105 countries, Nigeria ranked 80. This throws to the fore the fact that food insecurity problem in Nigeria is particularly access related (Olaniyi, 2014). Statistics of the census carried out by the Nigeria Population Commission (NPC) in the year 2006 estimated Nigeria's population to be 140 million with a growth rate of 3.5%. As a result, a larger amount of food resources will be required to guarantee food security and as such food security has therefore become a subject of global concern. It is agreed that the question of food security requires an interdisciplinary approach to solving, bringing the agriculturalists and nutritionists together (Global Food Security GFS, 2013) not excluding health educators. This review article is therefore aimed at documenting indigenous vegetables species in several parts of Nigeria, their nutritional and medicinal benefits and their importance in economic development.

**INDIGENOUS VEGETABLES OF NIGERIA**

Indigenous vegetables are available in wild and cultivated forms. Over 40 indigenous leafy vegetables are eaten in Nigeria, with the south-western part accounting for 24 of them (Adebooye *et al.*, 2003). Amongst the Tiv community in Benue state, North Central, Nigeria, a total of 42 wild plants species in 27 families have been identified as edible plants utilized by the local people and ruminants (Shomkegh *et al.,* 2013). Edwin-Wosu *et al,* (2012) carried out an ethnobotanical survey of indigenous vegetable species in Cross River State which revealed about 34 species which are part of their staple diet. In addition, 30 traditional leafy vegetables and spices were listed in a survey carried out in Ebonyi State, Southeast, Nigeria (Oselebe *et. al.*, 2013). Indigenous vegetables have played a significant role as food supplements during the times of drought and to fortify diets especially in hunter gatherer societies. Vegetables together with other wild plant foods are often referred to as the ‘hidden harvest’ (Harvest, 2011) since they are simply collected from the wild such as agricultural fields and swampy areas and require little or no cultivation. Table 1 shows a list of the indigenous vegetables cited in literatures from different parts of Nigeria.

**Table 1: Some Indigenous Vegetables of Nigeria**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Scientific name | Common name | Local name | Parts used | Geographical zone | Reference |
| Araceae family  *Xanthosoma sagittfolium* (L.)Schott  *Colocasia esculentus* L.  Amaranthaceae family  *Amaranthus hybridus* L.  *Amaranthus viridis* L.  *Amaranthus spinosus* L.  *Celosia argentea* L.  Asclepiadacaeae family  *Gongronema latifolium* Benth  Asteraceae family  *Vernonia amygdalina* L.  *Emilia coccinea* Cass.  *Solanecio biafrae (Olive &Heirne) C. Jeffry*  *Crasscocephalum crepidoides* (Olive& Herine) S.Moore  *Crasscocephalum togoense* L.  *Launea taraxacifolia* (Willd.)  Basellaceae family  *Basella rubra* L.  Bombacaceae family  *Bombax buonopozense* L. Gaertn.  Bignoniaceae family  *Newbouldia laevis* (P.Beauv)  Cucurbitaceae family  *Cucurbita pepo L.*  *Telfaria occidentalis Hook F.*  *Momordica charantia* L.  *Trichosanthes cucumerina* . L.  Caelsapinioideae family  *Daniella oliverii*  Convolvoluceae family  *Ipomoea batata* L.  Euphorbiaceae family  *Euphorbia hirta L.*  *Manihot esculentum* Krantz  *Uapaca heudoloti* Baill  *Tetracarpidium conophorum*  (Muell. Arg.) Hutch. & Dalziel  *Jatropha tanjorensis* L.  Fabaceae family  *Albizia zygia*  *Erythrina senegalensis* DC  *Pterocarpus soyauxii* Taub.  *Pterocarpus santalinoides* L’ Herit ex. DC  Gnetaceae family  *Gnetum africana* Welw.  Irvingiaceae family  *Irvingia gabonensis* Aubry-LeComte exO'Rorke) Baill  Laminaceae family  *Occimum grattissimum L.*  *Occimum basilicum* L.  Malvaceae family  *Abelmoschus esculentus* Moench.  Moraceae family  *Ficus glumosa* Del.  *Ficus capensis* Thunb.  Moringaceae family  *Moringa oleifera* Lam  Passifloraceae family  *Adenia cissampeliodes* Zepernick  Pedaliaceae family  *Cerathotheca sesamoides* E. Mey  Piperaceae family  *Piper guineense* Schum and Thonn.  Poaceae family  *Pennisetum purpureum* Schumach  *Imperata cylindrica*  Portulacaceae family  *Talinium triangulare* (Jack.) WIld.  *Portulaca oleracea* L.  Rubiaceae family  *Heinsia crinita* (Afzel.) G. Tayl.  Rutaceae family  *Zanthoxylum zanthoxyloides Lam.*  Sapindaceae family  *Lecaniodiscus cupanioides*  Sapotaceae family  *Chrysophyllum albidium* G. Don  *Synsephalum dulcificum*  (Schumacher & Thonn.) Daniell  Solanaceae family  *Solanum nigrum* L.  *Solanum macroacarpon* L*.*  *Solanum aethiopicum* L.    *Capiscum frutescens* L.  Tiliaceae family  *Corchorus olitorius* L.  Verbanaceae family  *Vitex doniana* | Cocoyam  Taro  African spinach  Green amaranth  Spiny amaranth  Quail tail  Amaranth globe  Bitter Leaf  Tassel flower  NA  Parsley leaf  NA  African lettuce  Indian Spinach  White silk cotton  Boundary Tree  Pumpkin  Fluted pumpkin  Bitter gourd  Snake Tomato  NA  Sweet potato  NA  Cassava  NA  NA  Catholic vegetable  WestAfrican albizia  Coral tree  African padauk  NA  African joint fir  NA  Scent leaf  Sweet basil  Okra, Ladies finger  Fig tree  Fig  Drumstick plant  Planch  False sesame  West African black pepper  Elephant grass  Cogon grass  Water leaf  Purslane  Bush apple  NA  NA  NA  African star apple  NA  Glossy night shade  Africa egg plant  Gilo  African pepper  Jute mallow  Black plum | *Koko*  *Opoto, Nkashi*  *Alefu*  *NA*  *Inene*  *Idodo*  *Utazi*  Olubu, Ewuro  Aninge  Worowo  Ebolo  NA  NA  Laali  Apkuto  Omirima  Ugbara  Ugwu  NA  Tomati elejo  Chiha  Ekwuoku  NA  NA  NA  NA  NA  Siri  NA  Oko  Okazi    Oro  Ahunji  Okazzi  Ila, Ophfuru  NA  Ekwuakpuru  Ekwuesisa  Isororo  NA  Uzuza  Eru  Hila  Ngbolodi  NA  NA  Nkaa  Ukpuocha  NA  NA  Odu, Anara  Igbagba  Akpoko  Ewedu, Anra  Uchakuru | Leaves  *Leaves, roots*  Leaves, stem  Leaves, stem  Leaves  Leaves  Leaves  Leaves, stem  Leaves, Flowers  Leaves  Leaves  Leaves  Leaves  Leaves, stem  Leaves  Leaves  Leaves, fruits  Leaves, seeds  Leaves, fruit  Leaves, fruit  Leaves  Leaves  Leaves  Leaves  Leaves  Fruits  Leaves  Leaves  Leaves  Leaves  Leaves  Leaves  Fruit  Leaves  Leaves  Leaves, fruit  Leaves, fruit  Fruit  Leaves, seed, stem, flower  Leaves  Leaves, flower  Leaves, seed  Leaves  Root  Leaves  Leaves  Leaves  Leaves  Leaves  Fruit  Fruit  Leaves, seed, flower  Leaves, fruit  Leaves, Fruit  Leaves  Leaves  Leaves | SS  SE  SS, SE,  SS, SE  SS, SE  SS, SE, NC  SE, SS  SE, SW,SS  NC  SW  SW  SW  SW  SE, SW  SE, SS  SE  SE, SW  SE, SW  SS, SW  SW  NC  SE  SS  SS  SS  SW  SS  SS  SS  SS, SE  NC, SS, SE  SS  SW  SW, SE, SS  SE, SS  SW, SE, SS  SS  SE  SE  SE  SW  SE, SS  SE  NC  SS, SE  SE  SS  SE  SE  SW  SW  SW, SE  SW  SW, SE, SS  SE  SW, SE, SS  SE, SS | 1  5, 6  4, 5  1, 5  5, 6  1, 4, 5  4, 7  3, 4, 5, 6, 7  2  3  3  3  3  1, 3  4, 6  6  3, 5, 6  1, 3, 4, 6  1, 3  3  2  6  1  1  4  3  1  1, 4  4  4, 7  2, 3, 4  4  3  1, 4, 6, 7  1, 4  1, 3, 6  4  6  6  6  3  1, 4, 6  5  2  1, 4, 5, 6  5  4  6, 7  6  3  3  3, 6, 7  3  4, 5  6  1, 3, 4, 5,6  4, 5, 6, 7 |

**Key:**

* **Reference:** 1 — Mensah *et al.,* (2008); 2 — Shomkegh *et al.,* (2013); 3 — Adebooye *et al,.* (2004); 4— Edwin-Wosu et al., (2012); 5 — Ogbu *et al.,* (2011); 6 — Oselebe et al., (2013); 7 — Nnamani et al. (2010)
* **Geographical Zone:** South West (SW); South East (SE); South South (SS); North Central (NC);

**THE GLOBAL CHALLENGE OF FOOD INSECURITY**

Globally, undernourishment affects about 900 million people and more than 2 billion suffer from micronutrient deficiencies (Fan *et al.,* 2012). The vast majority of the world’s hungry live in developing countries, Southern Asia faces the greatest hunger burden, with about 281 million undernourished people. In Sub-Saharan Africa, the current rate of undernourishment is currently around 23% per cent. Notwithstanding recent food production increases, nutritious foods remain unaffordable for many and the consequences are severe. Poor nutrition causes nearly half the deaths in children under five, and one in four children suffer stunted growth; 66 million primary school-age children attend classes hungry across the developing world, with 23 million in Africa alone (FAO, 2014). Without policy changes, obesity will increase in all countries and reach 3.28 billion by 2030, increasing non-communicable disease prevalence and health costs.

Sustainable agriculture still remains the foundation of food security and has the potential to secure livelihoods for several generations. Investing in smallholder farmers is an important way to increase food security and nutrition for the poorest, as well as food production for local and global markets. The World Health Organization (WHO) earlier reported that the consumption of fruits and vegetables is less than half (about 142g) of the recommended 400 g intake per day (WHO/FAO, 2003) and this requires urgent attention. The production of more food using fewer resources to meet a growing world population and ensure food security has therefore become a topic that generates global interest (Bvenura and Afolayan, 2015).

**NUTRITIONAL AND MEDICINAL IMPORTANCE OF INDIGENOUS VEGETABLES**

Micronutrient deficiency is a universal problem, which presently affects over 2 billion people worldwide, resulting in poor health, low worker productivity, high rates of mortality and morbidity. Deficiency in micronutrients has led to increased rates of chronic diseases and permanent impairment of cognitive abilities in infants born to micronutrient deficient mothers (Flyman and Afolayan, 2006). Local vegetables are important contributors to rural and urban people's diets in Nigeria (Barminas *et. al.*, 1998). They play an important role in traditional-food culture and various ethnic groups consume varieties of different indigenous types of vegetables for different reasons (Mensah *et. al.*, 2008). Approximately half of the leafy vegetables consumed in most Nigeria diets are from indigenous sources and they constitute significant micronutrients such as Vitamin C, Mg, Fe, Zn and Ca, proteins and fibre among other nutrients. (Lockett *et al.,* 2000; Grivetti and Ogle, 2000).

Vegetables serve as relish which is consumed alongside with main diets. They usually complement staple starchy diets which are made from cereals and tuber crops and they serve as substitutes for proteins in soups where they cannot be afforded. However, where alternative relish is available, they are referred to as supplements (Kepe, 2008). Indigenous vegetables have played significant roles as food supplements during times of drought and to fortify diets especially in hunter gatherer societies. Smith and Ezyaguirre, (2007) and Oniang’o *et. al.* (2003) stated that relish is an indispensable part of the African diet as the main staple cereal is not normally eaten in the absence of relish. Thus, the presence of relish directly impacts on the consumption of the bulk of the main staple even though the relish is required and consumed in smaller proportions relative to the staple. This relates so much to the importance of vegetable in enhancing satisfaction even at the household level.

Dark green vegetables aid the maintenance of alkalinity and supply chemical compounds which are able to retard the spread of degenerative disease in the human body due to their high vitamin, dietary fiber and mineral contents and antioxidant activity. Vegetables provide nutrients vital for health and maintenance of the body. Eating green vegetables which are rich in fiber may help regulate the digestive system thereby aiding bowel health and lowering the risk of colon cancer (Asaolu *et* *al*., 2012). Foliate intake can also reduce the risk of heart related disease such as heart attack and stroke. Leafy vegetables intake contributes to the production of serotonin, which help ward off depression as well as improving mood. Riboflavin and niacin are B vitamins that help prevent cataracts, while vitamin C help slow bone loss and decrease the risk of fractures. It also allows the body to make collagen which is a major component of cartilage, which aids in joint support and flexibility. (Madisa *et. al*., 2010). Large consumption of vegetables treats hemorrhoids, gallstones, obesity and constipation.

Green leafy vegetables used for soup preparation cut across different cultures within Nigeria and other parts of West Africa with similar cultural and socio economic background (Mensah *et. al.*, 2008). Indigenous vegetables possess medicinal properties in that they contain antioxidants which protect against oxidative stress caused by free radicals and reactive oxygen species. They help in preventing major ailments such as cardiovascular diseases and certain cancers (FAO/WHO, 2005). Indigenous vegetables are therefore necessary for proper human growth and physiology and are much more nutritive than the conventional ones such as spinach, kale and cabbage (Flyman and Afolayan, 2008). Vegetables containing antioxdants when consumed in sufficient amount would contribute greatly towards meeting human nutritional requirement for normal growth and adequate protection against diseases arising from malnutrition (Asaolu *et. al*., 2012). Bitter gourd (*Momordica charantia*)fruits are a rich source of β-carotene, vitamin C, folic acid, magnesium, phosphorus and potassium (Yuwai *et. al.*, 1991). The fruits are often used in folk medicine to treat type II diabetes, a rapidly spreading non-communicable disease that afflicts millions of people living in low- and middle-income countries (WHO, 2012; IDF, 2013). Almost all parts of pumpkin (*Curcubita spp.*) – fruit, leaves, flowers, and seeds are edible and can be prepared in a variety of dishes, using the fruit in soup, baked, stuffed, stir-fried or as a sweet dessert. Tender leaves and shoots are also good sources of micronutrients including provitamin A and minerals such as calcium, iron, and zinc. Growing vegetables, in particular leafy nutrient-dense species, in home gardens is important for families to obtain daily access to safe and nutritious food (Keatinge *et. al*., 2012). This is very important for reducing vitamin A and iron deficiency in vulnerable groups such as elderly people and pregnant women, and in improving maternal health and the health of children under five (Lyimo *et. al.,* 2003).Studies by Adebooye *et. al.* (2003) stated that plants are also sources of traditional medicine in southwest Nigeria and are used in treating various diseases and ailments. Many indigenous

vegetables species in sub-Saharan Africa, species such as Mmoringa (*Moringa oleifera*), Aamaranth

(*Amaranthus* spp.), Ssweet potato (*Ipomoea batatas*) leaves and Sspider plant (*Cleome gynandra*) also have high levels of anti-inflammatory phytochemicals such as flavonoids and other antioxidants that are of value to human health (Yang *et. al.,* 2013) in addition to their great nutritional value.

**BIOAVAILABILTY- THE CHALLENGE OF NUTRITIONAL CAPABILTIES IN INDIGENOUS VEGETABLES**

The food security concept of food utilization goes beyond food use and includes how a person is able to absorb essential nutrients from the consumed food (FAO, 2008) and this incorporates the concept of bioavailability. The bioavailability of nutrients is influenced by the presence in a meal of substances that either promote or inhibit absorption of nutrients by the gut (Lonnerdal 2003; Gupta *et. al.* 2006). These substances, which include phytate, oxalate and polyphenols are called anti-nutrients or anti-nutritional factors. They occur not only in indigenous and wild vegetables but also in cultivated vegetables and fruits (as oxalates), cereal and legume seeds (as phytates) and beverages such as tea and coffee (as polyphenols) (White and Broadly 2009).

Some authors have expressed their concern as to the ability of vegetables to meet the nutritional requirements of man. This is attributed to the presence of the antinutrients such as Tannins, saponins, phytates, oxalates, phytic acid and alkaloids. In the human body, oxalate binds to calcium to form calcium oxalate crystals that prevent the absorption and utilisation of calcium leading to diseases such as rickets and osteomalacia (Ladeji *et. al.,* 2004). Tannins have the ability to precipitate certain proteins by combining with digestive enzymes thereby making them unavailable for digestion (Abara, 2003). Phytic acid combines with some essential elements such as iron, zinc and phosphorus to form insoluble salts known as phytate. This prevents the absorption of these minerals by the body leading some mineral deficiency disorders. In Brazil, high levels of tannins were reported in the leaves of *Talinum fruticosum* (Leite *et al.,* 2009). However, some of these antinutirents can be lost during processing such as boiling, lanching and drying (Lola, 2009; Mosha *et. al.*, 1995a, b; Oboh, 2005; Yadav and Sehgal, 2003). Some commonvegetables including *Amaranthus, Solanum* and *Corchorus* species have been found to contain very low levels of antinutrients (Agbaire, 2012). The subject of bioavailability therefore requires adequate research so as to understand the effects of antinutrients and phytochemicals in the human to ensure optimum use of these important nutrient sources.

**THE ROLE OF VEGETABLES IN ECONOMIC GROWTH**

A pPositive correlation between vegetable commercialization and household income has been recognized over the years and the economic value of vegetables have confirmed by various researchers. For example, (Muriithi and Matz, 2015) found a positive welfare effect for vegetable producers in Kenya where fruit and vegetable crops generate more income for farmers compared to traditional staple crops in the region. In addition, they generate employment for the rural workers, and therefore improve access to food (Weinberger and Lumpkin, 2007). Vegetables constitute a source of cash income for the households and create opportunity to increase smallholder farmers’ participation in the market (Alemayehu *et. al.,* 2010). Vegetables are harvested fresh, dried and sold during offseason to generate income in rural households in Nigeria. Through the Nigeria-Canada Indigenous Vegetable Project, previously marginalized rural women farmers in Nigeria now realize an average income of about US$3,376/year from the sale of indigenous vegetables compared to a pre-project income figure of US$1,994/year due to increased yield (NICANVEG 2013). Vegetables are also used as source of raw material for local processing industry. A large proportion of gross domestic product can be generated within the primary sector by smallholder farmers.

Agricultural development has been shown to be up to four times more effective in reducing poverty relative to growth in other sectors, and growth in smallholder agricultural productivity has been shown to have a positive impact on both urban and rural populations in three key ways:

* + 1. lower food prices for consumers;
    2. higher incomes for producers and
    3. growth multiplier effects through the rest of the economy as demand for other goods and services increases (Alston *et. al.,* 2000).

The market share of indigenous vegetables in Nairobi, Kenya has been going up recently, accounting for about 30% of overall vegetable sales (Vorley *et. al.*, 2007). Likewise, the consumption of African leafy indigenous vegetables has been increasing in several countries in eastern Africa (Mwangi and Kimathi, 2006; Smith and Eyzaguirre, 2007; Chelang’a et. al., 2013) and Nigeria should therefore not be an exception.

**WOMEN AND INSTITUTIONAL ROLES IN VEGETABLE RESEARCH AND FUTURE DEVELOPMENT**

Global public spending on agricultural research and development reached US$ 31.7 billion in 2008 and has increased at an average annual rate of 2.4% since 2000, mostly driven by China, India and the United States (Beintema *et. al.,* 2012). Although data are not disaggregated by crop, it would be safe to say that very little of this money is spent on research for fruit and vegetables, and virtually none of it goes into the improvement of indigenous vegetables (Keatinge *et. al.,* 2015).In a country like Nigeria, these indigenous vegetable crops have been neglected by researchers, policy makers and funding agencies and are currently threatened with extinction, which would mean a substantive reduction in biodiversity (Adebooye and Opabode, 2004).

Indigenous vegetables are currently underutilized, and have been neglected by researchers and policy makers. Lack of prioritization by African governments and other stakeholders in terms of research is the major reason for genetic erosion of this species (Shackleton, 2003; Adebooye and Opabode, 2004). Transdisciplinary (Td) studies among researchers which use different methods to generate information can be used to gather up- to- date knowledge on indigenous vegetables. It is generally agreed that the question of food security requires an interdisciplinary approach to solving, bringing the agriculturalists and nutritionists together (Aragrande et. al., Argenti, & Lewis, 2001; Global Food Security (GFS), 2013; Ingram, 2011; Maunder & Meaker, 2007; Rocha, 2007). Community seed production and storage systems must be set up in villages, where growers can be trained to produce reasonably genetically pure seed to store in low relative humidity conditions after drying (Manzanilla *et. al.*, 2011; Ebert *et. al.*, 2013).

Women and children are usually the predominant gatherers of these important plant species. For example, a study of 135 different societies with various subsistence bases estimated that women provided 79% of total vegetal food collected (Barry & Schlegel, 1982; Howard, 2003). In South Africa, the Agricultural Research Council (ARC) is one of the institutions that has been at the forefront of promoting wild vegetables for food security and nutrition through research. Nigerian scientific, agricultural and economic organizations and institutions can collaborate in carrying out problem solving research on her indigenous vegetables. Baseline surveys need to be conducted in Nigeria to ascertain market values of wild vegetables. To promote indigenous vegetables, several researches on water use efficiency, plant nutrition; cultivation practices (planting methodology, spacing and harvesting, allelopathic effects and agronomic traits) are required to ensure domestication.

The Nigeria-Canada Indigenous Vegetable Project (NICANVEG, 2015) which was a collaboration between Obafemi Awolowo University, Ile Ife, Osun State University, Osogbo, University of Manitoba, Canada and Cape Breton University, Canada carried out researches on selection and improvement of genotypes, development of drought, pest and disease resistant varieties, and cultivation of wild vegetables under different conditions as well as the phytochemical and organoleptic studies of the vegetables. Studies on the nutritional composition of vegetables are required and controlled experiments on aspects such as effect of soil type, effect of fertilizer amount and type, and age of harvesting on the nutritional composition of vegetables need to be carried out.

However, conservation of genetic diversity and seed supply systems to store and supply a wide variety of indigenous vegetable species are of utmost importance. Such partnerships as these partnerships will generate a wealth of knowledge on indigenous vegetables and most of the work has been published or presented in conferences and academic gatherings.

The need for more in depth participatory studies on the indigenous knowledge systems about vegetable species as well as on their current importance in the household economy has been suggested by Mavengahama *et. al.* (2013). The abundance and diversity of these vegetables need to be determined. Diversity studies are especially important as a preliminary step in breeding of these species for desirable traits such as low anti-nutrients and low astringency, high micronutrient content as well as high yield of the edible parts. The potential of these vegetables to contribute to agro-biodiversity at farm and household level through intercropping them with other crops also needs to be explored. In addition, the possibility of commercializing indigenous vegetable production and making them available all year round needs to be researched.

More empirical studies on the nutritional values of underutilized species and their subsequent domestication may be an important step towards alleviating nutritional deficiencies among marginal input communities of Nigeria.

**CONCLUSION**

Vegetables have been part of human diet from time immemorial and as a result several measures should be put in place by all sectors so as to ensure their continuous availability. Perishability, seed viability and availability and pest and diseases are some of the factors necessary for consideration during domestication and commercial farming, Research on pest and diseases that affect productivity of indigenous vegetables is strongly encouraged. Appropriate post-harvest management and storage techniques are advised so as to reduce perishability of indigenous vegetables. It is recommended to place vegetable crops in a cool environment to prolong their shelf life.

Sharing and disseminating information about the different indigenous vegetable types and species, their nutritional value for health, and how they can be Preservation of important character traits of indigenous vegetables can be properly achieved through molecular characterization so as to prevent genetic erosion by exotic species. Furthermore, researches on morpho-genetic characterization to enable selection of species with desirable traits, agronomic and chemical evaluation and the effects of cooking and processing on chemical composition and nutritional value of these species are needed to generate adequate information. Molecular markers could be used to aid in the selection for low antinutritional levels and other undesirable characteristics. In Nigeria, Policy makers should support the generation of persuasive research-based information, and initiate suitable national legislation and information campaigns especially among the malnourished fraction of the population. There is need to educate the populace especially the rural dwellers on the inherent potentials of the indigenous vegetables so as to make them an important part of their mainstream diet in order to enhance food security, prevent malnutrition and generate income through extension the activities of extension workers and the mass media. Promotion of the use of indigenous vegetables among urban dwellers is highly recommended so as to annul the notion that vegetables are diets for the poor and hungry people.

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