

## **AFRICAN LEAFY VEGETABLES: THEIR ROLE IN THE WORLD HEALTH ORGANIZATION'S GLOBAL FRUIT AND VEGETABLES INITIATIVE**

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## ABSTRACT

The increased awareness of the health protecting properties of non-nutrient bio-active compounds found in fruits and vegetables, has directed immense attention to vegetables as vital components of daily diets. For sub-Saharan African (SSA) populations, this attention on vegetables as vital dietary components is significant, as leafy vegetables have long been known to be indispensable ingredients in traditional sauces that accompany carbohydrate staples. African indigenous and traditional leafy vegetables thus have a pivotal role in the success of the World Health Organization's (WHO) global initiative on fruits and vegetables consumption in the sub-continent.

The joint WHO/FAO 2004 report on a Global Strategy on Diet, Physical Activity and Health, recommended a minimum daily intake of 400g of fruits and vegetables. Also, at their 2004 joint Kobe workshop, the WHO and FAO developed a framework that proposes ways to promote increased production, availability and access, and adequate consumption of fruits and vegetables. This framework is expected to guide the development of cost-efficient and effective interventions for the promotion of adequate consumption of fruits and vegetables at the national and sub-national level.

This paper explores ways to integrate African indigenous leafy vegetables into the global fruit and vegetable programme initiative, and identifies some existing barriers to their effective mobilization. African Leafy Vegetables are increasingly recognized as possible contributors of both micronutrients and bio-active compounds to the diets of populations in Africa. Available data on the more commonly consumed varieties point to antioxidants containing leafy vegetables that can also provide significant amounts of beta carotene, iron, calcium and zinc to daily diets. How can the successful Nairobi leafy vegetable experience, be mainstreamed across the sub-continent to ensure their mobilization and integration in WHO's fruit and vegetable initiative? The Kobe framework recommends that fruit and vegetable promotion interventions should consider the process from production to consumption.

Very little is known about the production and consumption of African Leafy Vegetables. An expert report on patterns of vegetable consumption in the sub-continent lists common vegetables as onions, carrots, tomatoes and cabbage. Clearly, information on production, processing, distribution and marketing, preparation and consumption of vegetable species relevant to SSA, are vital and constitute the prop on which intervention programmes can be developed. Through its long collaboration with national governments, Bioversity International is well placed to catalyze the process of data generation and dissemination by countries in the sub-continent.

**KEY WORDS:** African Leafy Vegetables, micronutrients, antioxidants

## INTRODUCTION

The growing awareness in recent years of the health promoting and protecting properties of non-nutrient bioactive compounds found in fruits and vegetables, has directed increased attention to vegetables as vital components of daily diets. For populations in sub-Saharan Africa (SSA), this attention on vegetables as vital dietary components reinforces the significant roles that leafy vegetables have long held as important components in African diets; they are indispensable ingredients of soups or sauces that accompany carbohydrate staples [1].

African indigenous and traditional leafy vegetables (ALVs) thus have a pivotal role in the success within SSA, of the World Health Organization's (WHO) global initiative on increased consumption of fruit and vegetables. The joint FAO/WHO 2003 Consultation on Diet, Nutrition and the Prevention of Chronic Diseases recommended a minimum daily intake of 400g of fruits and vegetables [2]. WHO in 2004 again drew attention to this recommendation through its Global Strategy on Diet, Physical Activity and Health. At the joint Kobe workshop on fruit and vegetables for health, the WHO and FAO developed a framework that proposes ways to promote increased production, availability and access, and greater consumption of fruits and vegetables [3].

This framework is intended to guide the development of cost-efficient and effective interventions to promote the adequate consumption of fruits and vegetables at national and sub-national levels. This paper explores ways to integrate ALVs into the global fruit and vegetable initiative for improved health by identifying some existing barriers to their increased consumption and their effective mobilization as part of national agriculture, nutrition and health strategies. The authors also aspire to stimulate debate and exchange of ideas on the subject with a view of arriving at a set of recommendations on applicable, relevant and effective ways to mainstream indigenous and traditional leafy vegetables in global food, nutrition and health initiatives.

### Which are these Leafy Vegetables?

The words *indigenous* and *traditional* are used in this paper to describe leafy vegetables that have been part of the food systems in SSA for generations. Indigenous leafy vegetables are those that have their natural habitat on sub-Saharan Africa while the traditional leafy vegetables were introduced over a century ago and due to long use, have become part of the food culture in the sub-continent. The Plant Resources of Tropical Africa – PROTA, reported an estimated 6,376 useful indigenous African plants of which 397 are vegetables. In the same volume, it is indicated that information is available on cultivation practices for 280 indigenous African Leafy Vegetables [4].

There has been a resurgence of interest in the ALVs during the past decade with several studies reporting on their regional availability and use [1, 5-12]. In the April

2005 issue of Spore, the contributor observed that African “leafy vegetables are everywhere and nowhere, in books and on the internet there is a great deal of information on tropical green vegetables, but it is often scattered like leaves in the wind” [13]. Table 1 presents some of these leafy vegetables that are reported to be in current use.

This list is not exhaustive but represents leafy vegetables that have been commonly cited in recent literature reports. The regional availability of the vegetables is presented on Table 2. This table also highlights the vegetables that are more commonly available and consumed in more than one sub-region or all over the subcontinent. The varieties that are found to have more widespread regional usage could be prioritized and targeted for such programmes as the WHO/FAO initiative for the promotion of increased production and consumption of fruit and vegetables.

### **Role of African Leafy Vegetables in Health Promotion and Protection**

Quite a large number of African indigenous leafy vegetables have long been known and reported to have health protecting properties and uses [5,14-17]. Reporting on the Moringa plant (*Moringa oleifera*) in 1937, the British botanist Dalziel observed that the roots, leaves and twigs, as well as the bark of the tree are used in traditional medicine. Several of these indigenous leafy vegetables continue to be used for prophylactic and therapeutic purposes by rural communities (14, 17). This indigenous knowledge of the health promoting and protecting attributes of ALVs is clearly linked to their nutritional and non-nutrient bioactive properties. ALVs have long been, and continue to be reported to significantly contribute to the dietary vitamin and mineral intakes of local populations [18-30].

More recent reports have shown that they also contain non-nutrient bioactive phytochemicals that have been linked to protection against cardiovascular and other degenerative diseases although Orech and colleagues observed that some of these phytochemicals found in some ALVs consumed in Western Kenya may pose toxicity problems when consumed in large quantities or over a long period of time [10]. In spite of this body of evidence confirming the nutritional contribution of ALVs to local diets, and their health maintenance and protective properties, there has been very little concerted effort towards exploiting this biodiverse nutritional and health resource to address the complex food, nutrition and health problems of sub-Saharan Africa.

### **What do we know about the production of ALVs?**

Published information on the production of indigenous and traditional leafy vegetables tends to be anecdotal. There is very little published information or data on either the areas cultivated or the production levels of specific ALVs [5, 9, 13, 32-35]. The Spore 116 feature article quoting reports from the International Institute for Tropical Agriculture (IITA) indicated that the total 1998 production of leafy vegetables in Cameroon was estimated to be 93,600 tons of which 21,549 tons was of “bitter leaf”, *Vernonia amygdalina* [13].

Such valuable production data are often dispersed and difficult to compare, given the gaps in coverage and different methodologies used. Even the FAO database on vegetable production in sub-Saharan Africa fails to capture the indigenous and traditional vegetables that are commonly used on the subcontinent. Of the 15 vegetables documented in the FAO database, only tomatoes and mushrooms have some relevance to the diets of the majority of populations on the subcontinent [FAOSTAT 2004]. This is a serious shortcoming because information from this database is used to inform and guide policy initiatives globally and on the subcontinent specifically [34].

Reports on the diversity of traditional leafy vegetables in sub-Saharan Africa by Bioversity International show that there are more than 20 leafy vegetable species specific to Africa that are used in daily diets and are of nutritional importance [37]. Mirghani and colleagues and Okeno colleagues however reported that in contrast to cash crops, little attention has been paid to the production of indigenous leafy vegetables and so there is a dearth of data on their production levels [9, 5]. The availability of reliable information on the production of ALVs is crucial for any planned attempts to integrate them into the global fruit and vegetables initiative for improved health.

The Kobe framework recommends that fruit and vegetable promotion interventions should consider the whole process from production to consumption. This recommendation draws attention to the gap in knowledge and information on the production and consumption of African Leafy Vegetables. There is therefore a dire need in the subcontinent to close this knowledge and information gap as increasing global attention is turned towards mobilizing local biodiversity for food security and health.

### **Patterns of consumption of African Leafy Vegetables**

Information on the *per capita* consumption of African Leafy Vegetables is just as scarce as data on their production levels. It is generally believed that the introduction of exotic vegetable varieties contributed to the decline in the production and consumption of indigenous vegetables. However, literature reports of a steady decline in dietary intakes of these vegetables with the emergence of simplified diets are based on the assumption of declining use as a result of declining availability [5, 7, 38].

Contrary to this view, Maziya-Dixon *et al.* reported that in Nigeria, leafy vegetables are relatively available and affordable particularly during the rainy seasons but were found to be among the least consumed foods [39]. Ruel *et al.* also reported that fruit and vegetable consumption of these vegetables sub-Saharan Africa although in this study the reported common vegetables “included onions, carrots, tomatoes and cabbage” vegetables which are really not representative of African Leafy Vegetables [40].

Reports from the literature (Table 3) do not confirm the general belief of declining consumption of ALVs although it is not clear from some of the studies how the

consumption data were generated, what period of the year the studies were carried out and what specific vegetables were studied. Earlier reports had estimated *per capita* consumption of ALVs to be 80g of fresh leaves per day during high season in Senegal and Burkina Faso, while in Mauritania estimates were 65g/day in urban areas and 16g/day in rural areas [15, 41].

In Uganda, an average consumption of 160g/person/day during the rainy season was reported while another study amongst urban dwellers quoted in the same report estimated *per capita* consumption of 12g/day [8]. Oguntona reported a mean intake of 65g/day in western Nigeria while in a more recent study in south eastern Nigeria, Hart and colleagues reported adult *per capita* consumption of 59-130g/day during the months of May-July, the peak season of vegetable production in the study area [42, 43].

There have been other attempts at estimating consumption patterns using household expenditures on ALVs, or general survey of usage, but these estimates indicate only trends in leafy vegetable consumption [13, 44, 45]. Gockowski and colleagues reported that in Cameroon, ALVs remain important dietary components although household expenditure on ALVs declines as total expenditure grew suggesting that consumption decreases with increasing income [44]. A recent IITA report on Senegal indicated that leafy vegetables account for as much as 50-85% of household budget for some farmers [13].

These reports provide at best only a glimpse into the consumption patterns of ALVs on the subcontinent but the information provided is very limited and so should be interpreted with caution and should not be considered as baseline information for the respective countries or regions. Nevertheless, they highlight the immense information gap on ALV consumption in sub-Saharan Africa. There is clearly a need for more regionally targeted studies on the *per capita* consumption of ALVs as data from such studies provide valuable baseline information which is vital both in the development of the ongoing WHO/FAO vegetable consumption promotion strategies for SSA as well as in evaluation of the effectiveness of current and future interventions.

### **Some vital pre-promotion activities for greater consumption of African Leafy Vegetables**

In spite of the abundance of African indigenous and traditional leafy vegetables, they remain under-exploited and under-utilized due to various listed constraints [5, 6, 33, 37, 46-48]. The resolution of these production and consumption bottlenecks, are crucial prerequisites for the integration of ALVs into WHO's global initiative for fruit and vegetable consumption promotion. These constraints relate to production, processing, distribution and marketing, as well as nutrition information on a large number of regionally specific cultivars. However, one of the first items in the priority list of activities needs to be the identification of regionally common species that could constitute the starting material for planned and concerted multi-sectorial research and development activities.

Seed availability, variability in seed quality, lack of seed selection for uniformity of desired traits, plant pests and disease are some of the agronomic constraints that require urgent research inputs. Given the relative lack of research thus far, a small investment in improved seed quality, seed supply, and improved agronomic practices is likely to yield a large return. Taxonomy is another often cited production related constraint. Farmers and local populations identify the different leafy vegetable species and cultivars by their local names, but quite often the same local generic type name is applied to two or more cultivars. With the increasing interest in cultivar specific health promoting and protecting traits, and the desire of the health community to increase public awareness of these traits, it is important that the leafy vegetables are correctly identified by both their botanical and local names. This characterization provides the basis for identifying the variation on nutrients and health protecting traits among cultivars within a given vegetable species.

There is need to develop and promote locally appropriate processing techniques to minimize post harvest losses and ensure regular supplies of ALVs from the production areas to consumers in peri-urban and urban centres. The easy perishability of African Leafy Vegetables poses major challenges with their distribution and marketing. Drying has been an African way of processing leafy vegetables to make them available during periods of shortages. Drying is one solution to the problem of perishability but it does not satisfy the needs of a large population of consumers, particularly urban dwellers who prefer freshly harvested vegetables. Furthermore, not enough is known on how drying and reconstitution when cooked affect the nutritional quality of the vegetables. There are also other food safety issues such as toxicity and microbial contamination that require research attention as strategies are put in place for the promotion of increased consumption of these leafy vegetables.

A significant number of these ALVs are not consumed particularly by the younger generation of Africans because of their unfamiliar tastes or ignorance of how to prepare them [10, 5, 7]. Perhaps a crucial component of the leafy vegetable promotion strategy should be their re-introduction into the daily food habits of the peri-urban and urban populations in particular through recipes developed to show traditional and modernized ways of preparing these under-utilized food ingredients. The recipes should encourage the use of the ALVs in preparing foods other than accompanying sauces in order to ensure that the vegetables are used at least twice daily, thus increasing the opportunities for their consumption.

Community women's groups, women's cooperative groups and other women's social groups would be valuable assets in recipe development projects aimed at show-casing African Leafy Vegetables. The International Plant Genetic Resources Institute in collaboration with the Kenyan Centre for Indigenous Knowledge/National Museums of Kenya has taken the lead and is in the process of publishing a compilation of regional leafy vegetable recipes in a cookbook titled "African Leafy Vegetable Cookbook" featuring recipes from several sub-Saharan African countries.

Regionally appropriate measuring tools and standards need to be established to ensure specificity in portion sizes, information that will be required for promotion activities.

The WHO recommendation is for a minimum daily intake of 400g of fruits and vegetables [2]. It is not clear from the report what proportion of this total daily intake should go to vegetables. However according to the Kobe framework document and an FAO report the recommended total daily intake is equivalent to 5 servings of 80g each of fruits and vegetables [3, 49].

The FAO report goes on to suggest that “a helping of cooked vegetable or raw leafy greens similar to the size of your fist may also be considered one serving”[49]. What constitutes a serving of leafy vegetables in the African context? There are obvious cultural differences in the way vegetables are prepared and consumed. In several parts of sub-Saharan Africa, leafy vegetables are for the most part consumed cooked in accompanying sauces to carbohydrate staples or cooked mixed with tubers such as yam, cocoyam, cassava or sweet potato.

Clearly a fistful of fresh green leafy vegetable or 5 fists depending on the size of the family sharing the sauce pot may not come to much in the pot of sauce. The differences in the way leafy vegetables are prepared and consumed would influence ways of determining portion sizes. The challenge for nutritionists and food science researchers in the subcontinent is to develop regionally appropriate measures of portion size bearing in mind locally and commonly used handy household tools that are used in food preparation, as well as local food preparation techniques.



## CONCLUSION

The experience in Kenya and neighbouring countries shows that a combination of cultural pride, interest in healthy foods, and a growing taste for diversity is creating a favourable opportunity to protect and revitalize ALVs as a nutritious resource derived from Africa's biological and cultural diversity. What Bioversity and its partners can do is to help develop and provide the tools to better classify the diversity within and across species, and foster partnerships that would mobilize this diversity and make the vegetables easier to obtain and more widely consumed. The list of challenges – agronomic, processing, distribution and marketing, cultivar-specific nutritional characterization, establishing portion sizes, is long and daunting but the goal of integrating African Leafy Vegetables into the global nutrition and health initiative has been clearly defined. This workshop provides a singular opportunity for the stakeholders in the agriculture and health communities of the sub-continent to take the necessary first steps and chart the path towards meeting this goal.

**Table 1:** Regionally Consumed Indigenous And Traditional Leafy Vegetables

| <b>WEST AFRICA</b>          | <b>EAST &amp; CENTRAL AFRICA</b> | <b>SOUTHERN AFRICA</b> |
|-----------------------------|----------------------------------|------------------------|
| Abelmoschus esculentus      | Abelmoschus esculentus           | Abelmoschus esculentus |
| Amaranthus caudatus         | Acalypha biparlita               | Amaranthus caudatus    |
| Amaranthus cruentus         | Amaranthus cruentus              | Amaranthus chirotarota |
| Amaranthus hybridus         | Amaranthus dubius                | Amaranthus cruentus    |
| Basela alba                 | Amaranthus lividus               | Amaranthus hybridus    |
| Celosia argentea            | Amaranthus spinosis              | Amaranthus spinosus    |
| Citrullus lunatus           | Basela alba                      | Amaranthus thunbergi   |
| Colocasia esculenta         | Bidens pilosa                    | Bidens pilosa          |
| Corchorus oliterius         | Citrullus lanatus                | Brassica carinata      |
| Corchorus olitorius         | Cleome gynandra                  | Brassica juncea        |
| Crassocephalum biafrae      | Colocasia esculenta              | Cassia occidentalis    |
| Crassocephalum crepidioides | Corchorus olitorius              | Chenopodium album      |
| Crassocephalum rubens       | Crotolaria brevidens             | Cleome gynandra        |
| Cucurbita maxima            | Cucurbita maxima                 | Cleome momophylla      |
| Cucurbita pepo              | Cucurbita moschata               | Corchorus olitorius    |
| Gnetum africanum            | Hibiscus sabdariffa              | Corchorus tridens      |
| Gongronema latifolium       | Ipomea batatas                   | Cucumis angura         |
| Hibiscus cannabinus         | Lagenaria siceraria              | Cucurbita maxima       |
| Hibiscus sabdariffa         | Manihot esculenta                | Mormodica balsamina    |
| Ipomea batatas              | Moringa oleifera                 | Physalis viscosa       |
| Launea taraxacifolia        | Moringa stenopetala              | Portulaca oleracea     |
| Manihot esculenta           | Portulaca quadrifida             | Solanum nigrum         |
| Moringa oleifera            | Senna occidentalis               | Taxaxacum officinale   |
| Occimum basilicum           | Sesamum angustifolium            | Vigna unguiculata      |
| Occimum grattissimum        | Sesamum calycimum                | Wahlenbergia undulata  |
| Portulaca oleracea          | Sida acuta                       |                        |
| Pterocarpus mildbreadii     | Solanum aethiopicum              |                        |
| Solanum aethiopicum         | Solanum gilo                     |                        |
| Solanum macrocarpon         | Solanum indicum                  |                        |
| Solanum melongena           | Solanum nigrum                   |                        |
| Solanum scarbrum            | Solanum scabrum                  |                        |
| Struchium sparganophora     | Sonchus carnatus                 |                        |
| Talinium triangulare        | Sonchus oleraceus                |                        |
| Telferia occidentalis       | Talinium triangulare             |                        |
| Vernonia amygdalina         | Vernonia amygdalina              |                        |
| Vigna unguiculata           | Vigna unguiculata                |                        |

**Table 2:** Distribution Of Some Regionally Commonly Found Leafy Vegetables  
 (From Literature Reports\*)

| All over the Subcontinent  | West/East & Central Africa   | West and Southern Africa   | East/Central and Southern Africa                   |
|--|--|--|--|
| Abelmoschus esculentus<br>Amaranthus cruentus<br>Corchorus olitorius<br>Cucurbita maxima<br>Vigna unguiculata<br>Solanum macrocarpon | Basella alba<br>Citrullus lunatus<br>Colocasia esculenta<br>Hibiscus sabdariffa<br>Ipomea batatas<br>Manihot esculenta<br>Solanum aethiopicum<br>Solanum scarbrum<br>Talinium triangulare<br>Vernonia amygdalina<br>Moringa oleifera | Amaranthus caudatus<br>Amaranthus hybridus<br>Portulaca oleracea | Solanum nigrum<br>Bidens pilosa<br>Cleome gynandra |

\*Literature Sources from West Africa – Nigeria, Ghana, Benin, Senegal  
 East & Central Africa – Kenya, Uganda, Cameroon, Gabon, Zambia, Tanzania, Ethiopia  
 Southern Africa – South Africa, Zimbabwe

**Table 3:** Some Reported Patterns Of Consumption Of African Leafy Vegetables

| Country of Study/Report | Per Capita Consumption | Season        | Urban/Rural | Year of Study/Report | Reference                         |
|-------------------------|------------------------|---------------|-------------|----------------------|-----------------------------------|
| Senegal/Burkina Faso    | 80g                    | Rainy season  | Rural       | 1937                 | Dalziel (15)                      |
| Uganda                  | 12g                    | Not specified | Urban       | 1957                 | Grant, MW quoted by Rubaihayo (8) |
| Uganda                  | 160g                   | Rainy season  | Rural       | 1989                 | Goode, PM quoted by Rubaihay (8)  |
| Mauritania              | 65g                    | Not specified | Urban       | 1989                 | Frankenberger <i>et al</i> (41)   |
| Mauritania              | 16g                    | Not specified | Rural       | 1989                 | Frankenberger <i>et al</i> (41)   |
| Nigeria                 | 65g                    | Not specified | Rural       | 1998                 | Oguntona, T (42)                  |
| Nigeria                 | 91-130g                | Rainy season  | Urban       | 2005                 | Hart <i>et al</i> (43)            |
| Nigeria                 | 59-64                  | Rainy season  | Rural       | 2005                 | Hart <i>et al</i> (43)            |

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