

INDIGENOUS LEAFY VEGETABLES WITH POTENTIAL MEDICINAL AND IMMUNE BOOSTING PROPERTIES

Daniel Patrick Kisangau

Department of Biology, South Eastern Kenya University
P.O Box 170-90200, Kitui-KENYA

ABSTRACT

Many studies have been carried out on the nutritive value of indigenous leafy vegetables but few have been done on the medicinal value of these traditional vegetables. A study was carried out to document the medicinal and immunoboosting value of indigenous leafy vegetables (ILVs) used traditionally by vulnerable groups (children, pregnant mothers, people living with HIV/AIDS) in Kenya. Descriptive data were collected from a total of 65 respondents. Using open-ended questionnaire, ethno medicinal surveys were carried out from November to December 2016 in Kakamega and Kilifi counties in Kenya. A total of 14 ILV species were described. Of these, 12 were reported by the respondents to boost body immunity across the vulnerable groups; 11 species were reported to treat various conditions across the groups. There was a general consensus of use of ILV species as therapeutic and immunoboosters across the three groups. A cross cultural analysis found that six ILV species were used in both counties of Kakamega and Kilifi. These were *Amaranthus dubius*, *Cleome gynandra*, *Corchorus solitorius*, *Cucurbita maxima*, *Solanum villosum* and *Vigna unguiculata*. The study forms a basis for development of value added products in standardized formulations containing ILVs to address the documented or other related human health challenges.

Keywords: Ethno medicine, Traditional vegetables, human health, Developing countries

Introduction

Indigenous leafy vegetables (ILVs) include species which are wild, semi-cultivated, or protected in some way, and are among plants sought as part of the diet, and for therapeutic purposes [1, 2]. These vegetables form a substantial proportion of the diets of most low- and middle-class people in many developing countries. They are usually inexpensive, easily accessible, and sources of micronutrients. Most research has concentrated on nutritional value and conservation of traditional vegetables [3, 4, 5]. There has been little published work addressing the issue of the perceived overlap between food and medicinal plants. Diets rich in vegetables are associated with health benefits [6, 7, 8]. Consumption of indigenous leafy vegetables can protect humans against oxidative damage and boosting of body immunity in certain cases. This oxidative damage

has been associated with an increased risk of cardiovascular disease, cancer and other chronic disease [9].

Although nutritive value of ILVs has been studied extensively, revealing high content of macro- and micro-nutrients, priority has been given to the exotic vegetables, while little work has focused on the medicinal value of African indigenous vegetables [10, 11, 12].

The aim of the present study was to document traditional medicinal knowledge of ILVs used by vulnerable groups (pregnant mothers, children and people living with HIV/AIDS) in Kenya. According to WHO [13], children, pregnant women, elderly people, malnourished people, and people who are ill or immunocompromised, are particularly vulnerable when disaster strikes, and take a relatively high share of the disease burden associated with emergencies. Maternal and child mortality remains a big challenge in Kenya just like in many other developing countries. Much of the mortality is associated with malnutrition and disease infections which directly affect the immunity of both the mother and the child especially to the majority poor in the rural areas of the country [14]. On the other hand, people living with HIV/AIDS are among the very vulnerable groups in the society. This has posed a big risk to most rural communities who have limited access to modern health facilities and cannot afford the usually expensive conventional drugs. Furthermore, the side effects associated with use of antiretroviral drugs by people living with HIV/AIDS is pushing many of them to seek alternative sources of managing the pandemic [15, 16]. Majority of rural population in many developing countries heavily rely on medicinal plants for managing various disease conditions including HIV/AIDS [17, 18]. Thus, identification and documentation of ILVs with medicinal and immune boosting properties could be developed into natural products that could be incorporated into the diet and enhance survival of these vulnerable groups of people.

2.0 Materials and methods

2.1 Description of study area

The Survey of ILV species was carried out from November to December 2016 in Kakamega and Kilifi counties in Western and Coastal parts of Kenya respectively. These regions are known in their frequency of use of traditional leafy vegetables.

Kakamega County, located at 0.2837° N, 34.7515° E is predominantly occupied by the Luhya tribe. The climate is tropical with average temperature of 20.4°C and annual precipitation of about 1971 mm [19].

Kilifi County, located at 3.2184° S, 40.1151° E is predominantly occupied by the Mijikenda tribe. The climate is equally tropical with average annual rainfall ranging from 300 mm in the interior to 1,300 mm at the coast. The annual temperatures in the county ranges between 21 and 30°C at the coast belt and between 30 and 34°C in the interior[20].

2.2 Data collection

In order to obtain the data a semi-structured open-ended questionnaire was used to collect respondent knowledge regarding health beneficial properties of ILV species. The emphasis was on traditional vegetables used by pregnant mothers, children, or people living with HIV/AIDS. A total of 65 households were visited and interviewed in each county. Interviews were conducted in Kiswahili language and where necessary an interpreter was used in the interviews. Random sampling was used to select respondents in the counties [21]. All respondents were required to sign a Prior Informed Consent for purposes of protecting their Intellectual Property Rights. Information was sourced from adult respondents, preferably 50 years and above, as these were more experienced and custodians of indigenous knowledge. The respondents were used as guides during field excursions to collect plant specimens. They were requested to provide information on local names of vegetable species used in meals, the kind of meals in which used, types of medicinal uses, diseases treated and preparation methods. Voucher specimens were collected, identified, coded and deposited in South-eastern Kenya University herbarium.

3.0 Results

Of the 65 respondents interviewed, 49 (75%) were women, 16 (25%) were men. A total of 14 ILV species were described. 11 of these species were used to treat 11 kinds of health conditions; anemia, indigestion, malnutrition, baby colic, dry cough, malaria, hypertension, ulcers, eye problems, sores and bacterial infections (Table 1). Of these conditions, 5, 5 and 4 ILV species were used to treat anemia, indigestion and hypertension respectively. *Amaranthus dubius* Mart. ex Thell was used to treat 4 health related conditions, followed by *Vigna unguiculata* (L.) Walp. *Corchorus olitorius* L. and *Launaea cornuta* (Hochst ex Oliv. & Hiern) C. Jeffrey with 3 each.

A total of 12 ILV species were described as being used to boost body immunity across the groups, pregnant mothers, children and people living with HIV/AIDS. Four ILV species (*A. dubius*, *L. cornuta*, *Moringa oleifera* Lam. and *V. unguiculata*) were associated with boosting body immunity across the three groups. Two of them (*Asystasiagangetica* (L.) T. Anderson and *Cleome gynandra* L.) were associated with boosting body immunity in pregnant mothers and people living with HIV/AIDS. Two species (*Basella alba* L. and *C. olitorius*) were used for children and pregnant mothers (Table 2). *Celosia trigyna* L. and *Solanum villosum* Mill. were used

for people living with HIV/AIDS while only one species *Chenopodium murale* L. was used for children.

Five ILV species had either common uses, or were used differently across the three groups in the two counties. These were *A. dubius*, *C. gynandra*, *Cucurbita maxima* Duchesne, *S. villosum* and *V. unguiculata* (Table 2). There was a general consensus of use of ILV species for both medicinal purposes and boosting body immunity in the study area. All ILV species were prepared and taken during meals. *Brassicacarinata* A.Br. *B. alba* and *S. villosum* were described to have become rare in the wild.

4.0 Discussion

The fact that 75% of the respondents were women while 25% were men confirmed the critical role played by women in utilizing ILVs for households' food preparations. Previous studies have noted that vegetable preparation for the meals in most households was mainly by women [6]. The use of the majority of the described ILV species in immune boosting translates to the potential of these vegetables in managing HIV/AIDS related conditions which in most cases challenge the immune system of the affected persons. The study confirms the long term traditional use of ILV species in treating human health conditions, which is generally done as part of family common meals. Several ILV species are used for prophylactic and therapeutic purposes in rural communities [22, 23].

Use of ILVs mainly to treat anaemia, indigestion and hypertension implies that the species can, if value added, be developed as food supplements to address these health challenges that mainly affect children, the elderly, PLWAs and pregnant mothers. A previous study by Mensah et al. [24] confirmed that among other health challenges, anaemia was one of the most common health conditions treated using ILVs. Studies have also revealed that consumption of ILVs can protect humans against oxidative damage associated with increased risk of cardiovascular disease, cancer and other chronic disease [9]. The species are consumed, especially during the dry seasons for their medicinal properties, nutritive value and eating habits linked to specific ethnic traditions [22].

The two counties where data was collected are distant from each other and ethno botanical consensus on the use of vegetables was regarded as highly corroborative, and therefore could offer reliable information towards determination of bioactive metabolites that could be either individually isolated or synergistically developed to conventional and verifiable standardized formulations to address the corresponding health challenges [25, 26]. Vegetables as medicinal plants contain none or less toxic effects than most conventional generic drugs, and have the ability to synthesize several secondary metabolites of relatively complex structures possessing

antimicrobial activities[27]. These non-nutrient, bioactive, metabolites have been linked to protection against cardiovascular and other degenerative diseases [28, 23]. These phytochemicals help lower risks of occurrence of chronic diseases [29].

In order to save biodiversity, it is necessary to cultivate and use sustainably *B. carinata*, *B. alba* and *S. villosum*, ILV species that are becoming rare to ensure their continuous supply and availability to the local community. Chivenge [30] stated that climate change and variability have resulted in negative effects on local food production and food and nutritional security offered by ILVs at the local level. The rate of loss of most ILVs has been exacerbated by frequent droughts, pest and diseases, over exploitation, over grazing, land clearance, deforestation and lack of incentives for farmers to maintain this agro-biodiversity [31, 30].

5.0 Conclusion

The ILVs play a critical role in the diet and health of most rural households, and may have potential to address food insecurity faced by poor families in developing countries. The therapeutic and immunomodulatory potential of the documented ILV species places them at a competitive edge against conventional crops and food stuff due to their use as diet in most rural homes. This forms a clear basis for their sustainable use and development through value addition to derive standardized formulations of ILVs food stuff with nutritive, therapeutic and immunomodulatory properties. The ILV species with cross cultural use could form a strong basis for further studies especially in extracting bioactive metabolites of therapeutic and immunomodulatory importance. Thus, further studies should be conducted in order to validate the medicinal and immune boosting claims by the local people. Public awareness of the nutritive value of ILVs needs to be improved so that they are not considered just a “poor man’s” food. Development of value added products in standardized formulations containing ILVs is also encouraged.

Acknowledgement

I am indebted to the International Foundation for Science for supporting this work through a research grant number F/4190-2. I am grateful to the respondents and local administration in Kilifi and Kakamega Counties for their cooperation during the period of data collection.

References

1. Thongam B, Kongsam S, Kumar AH. Assessment of wild leafy vegetables traditionally consumed by the ethnic communities of Manipur, northeast India. *J. Ethnobiol. Ethnomed.* 2016; 12: 9.

2. Guarrera PM, Savo V. Wild food plants used in traditional vegetable mixtures in Italy. *J Ethnopharmacol.* 2016, 185:202-234.
3. Turner NJ, Luczaj T.J, Migliorini P, Pieroni A, Dreon A.L, Sacchetti L.E, Paoletti MG . Edible and tended wild plants, Traditional ecological knowledge and agroecology. *Crit. Rev. Plant. Sci.* 2011, 30:198-225.
4. Ghosh-Jerath S, Singh A, Kamboj P, Goldberg G, Magsumbol M S. Traditional Knowledge and Nutritive Value of Indigenous Foods in the Oraon Tribal Community of Jharkhand: An Exploratory Cross-sectional Study. *Ecol. Food. Nutr.* 2015, 54(5): 493–519.
5. Ghosh-Jerath S, Singh A, Magsumbol MS, Kamboj P.1, Goldberg G. Exploring the Potential of Indigenous Foods to Address Hidden Hunger: Nutritive Value of Indigenous Foods of Santhal Tribal Community of Jharkhand, India. *J. Hunger Environ. Nutr.* 2016, 11(4):548-568.
6. Tumwet TN, Kang’ethe EK, Kogi-Makau W, Mwangi AM. Diversity and immune boosting claims of some African indigenous leafy vegetables in Western Kenya. *Afr. J. Food Agri. Nutri. Dev.* 2014, 14(1):8529-8544.
7. He FJ, Nowson C.A, MacGregor GA. Fruit and vegetable consumption and stroke: Meta-analysis of cohort studies. *Lancet.* 2006, 367:320-326.
8. Hung HC, Joshipura KJ, Jiang R, Hu F.B, Hunter D, Smith-Warner SA, Colditz GA, Rosner B, Spiegelman D, Willett WC. Fruit and vegetable intake and risk of major chronic disease. *J. Natl. Cancer. Inst.* 2004, 96(21):1577-1584.
9. Kadiri O, Olawoye B. Underutilized indigenous vegetable (UIV) In Nigeria: A rich source of nutrient and antioxidants - A review *Annals Food Sci. Technol.* 2015, 16(2):236-247.
10. Abukutsa-Onyango, MO. The diversity of cultivated African leafy vegetables in three communities in western Kenya. *Afr. J. Food Agri. Nutri. Dev.* 2007, 7(3):1-15.
11. Herforth AW. Promotion of Traditional African Vegetables in Kenya and Tanzania: A case study of an intervention representing emerging imperatives in global nutrition. Dissertation, Cornell University, 2010.
12. Ramalingum N, Mahomoodally M F. The Therapeutic Potential of Medicinal Foods. *AdvPharmacol Sci.* 2014, 354264.
13. WHO. Children's health and the environment - a global perspective. A resource manual for the health sector, 2005.

14. WHO. Trends in maternal mortality: 1990 to 2015: estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division, 2015.
15. Kose S, Mandiracioglu A, Mermut G, Kaptan F, Ozbel Y. The Social and Health Problems of People Living with HIV/AIDS in Izmir, Turkey. *Eurasian J Med.* 2012, 44(1): 32–39.
16. Moradi G, Mohraz M, Gouya MM, Dejman M, Seyedalinaghi S, Khoshravesh S, Ardakani HM. Health Needs of People Living with HIV/AIDS: From the Perspective of Policy Makers, Physicians and Consultants, and People Living with HIV/AIDS, *Iran Journal of Public Health.* 2014, 43(10): 1424–1435.
17. Lamorde M, Tabuti, JRS, Obua C, Kukunda-Byobona C, Lanyero H, Byakika-Kibwika P, Bbosa GS, Lubega A. Medicinal plants used by traditional medicine practitioners for the treatment of HIV/AIDS and related conditions in Uganda *J Ethnopharm.* 2010, 130 (1):43–53.
18. Sofowora A, Ogunbodede E, Onayade A. The Role and Place of Medicinal Plants in the Strategies for Disease Prevention. *Afr J Tradit Complement Altern Med.* 2013, 10(5): 210–229.
19. Anonymous. Kakamega County Integrated Development Plan, 2013-2017. Government of Kenya, Nairobi, Kenya. 2015a
20. Anonymous. Kilifi County integrated development plan, 2013-2017. Government of Kenya, Nairobi, Kenya. 2015b.
21. Kothari CR. *Research methodology: Methods and techniques*, 2nd ed. New Age International Publishers, New Delhi, India, 2004.
22. Gueye M, Diouf M. Traditional leafy vegetables in Senegal: Diversity and medicinal uses. *Afr. J. Tradit. Complement. Altern. Med.* 2007, 4(4):469-475.
23. Opiyo, AM, Mungai N.W, Nakhone LW, Lagat JK. Production, status and impact of traditional leafy vegetables in household food security: a case study of Bondo District -Siaya County-Kenya. *J. Agric. Biol. Sci.* 2015, 10:9.
24. Mensah JK, Okoli RI, Ohaju-Obodo JO, Eifediyi K. Phytochemical, nutritional and medical properties of some leafy vegetables consumed by Edo people of Nigeria. *Afr. J. Biotechnol.* 2008, 7 (14):2304-2309.
25. Kisangau DP, Lyaruu HVM, Hosea KM, Joseph CC. Use of traditional medicines in the management of HIV/AIDS opportunistic infections in Tanzania: a case in the Bukoba rural district, *J Ethnobiol Ethnomed.* 2007, 3: 29.

26. Cassandra LQ, Pieroni A. A reservoir of ethnobotanical knowledge informs resilient food security and health strategies in the Balkans, *Plant Nat.* 2015, 14021: 2014-2021.
27. Bhat RS, Al-Daihan S. Phytochemical constituents and antibacterial activity of some green leafy vegetables. *Asian Pac. J. Trop. Med.* 2014. 4(3):189-193.
28. Smith FI, Eyzaguirre P, African leafy vegetables: their role in the World health organization's global fruit and vegetables initiative, in: Oniang'o, R., Grum, M. and Obel-Lawson, E., editors. *Developing African leafy vegetables for improved nutrition. Regional workshop, 6-9 December 2005. Rural Outreach Program, Nairobi, Kenya, 2008.*
29. Hunter LM, Twine W. Adult mortality and household dietary use of the local environment: Qualitative evidence from the Agincourt field site in rural South Africa. *Institute of Behavioral Science Working Paper EB 2005-0001. Research Program on Environment and Behavior, University of Colorado at Boulder, Boulder, CO, 2005.*
30. Chivenge P, Mabhaudhi T, Modi AT, Mafongoya P. The potential pole of neglected and underutilised crop species as future crops under water scarce conditions in sub-Saharan Africa. *Int. J. Environ. Res. Public Health.* 2015, 2(6):5685-5711.
31. Van de Wouw M, Kik C, van Hintum T, van Treuren R, Visser B. Genetic erosion in crops: Concept, research results and challenges. *Plant Genet. Resour.* 2010, 8:1-15.

Table 1: Medicinal uses of indigenous leafy vegetables

Scientific name	English name	Local name	County in which local Name is used:	Condition treated
<i>Amaranthus dubius</i>	Amaranth	Libokoi (Mchicha)	Kakamega	Anemia; indigestion; dry cough; sores
		Kiswenya/Mchicha	Kilifi	
<i>Asystasiagangetica</i>	Chinese violet	Tsimboka Chibwada	Kakamega Kilifi	Hypertension; bacterial infection
<i>Brassica carinata</i>	Ethiopian kale	Likabichilyamanyonyi	Kakamega	Anemia; indigestion
<i>Cleome gynandra</i>	Spider plant	Tsisaka/Lisaka Mgagani	Kakamega Kilifi	Hypertension; eye problems
<i>Corchorus solitorius</i>	Jute mallow	Murere/Omurere	Kakamega	Indigestion; malnutrition; hypertension
<i>Crotalaria brevidens</i>	Ethiopian rattlebox	Imito	Kakamega	Indigestion
<i>Cucurbita maxima</i>	Pumpkin	Sebebe/Lisebebe	Kakamega	Anemia
		Tsatsatsa Mutsunga	Kilifi Kilifi	
<i>Launaeacornuta</i>	Wild lettuce	Mzungi	Kilifi	Indigestion; malaria; hypertension
<i>Moringaoleifera</i>	Drumstick	Mzungi	Kilifi	Anemia; malaria; ulcers
<i>Solanum villosum</i>				Malnutrition; bacterial infection
<i>Vigna unguiculata</i>	Cowpea	Likhubi	Kakamega	Anemia; malnutrition, baby colic
		Mkunde/Tsafe	Kilifi	

Table 2: Indigenous leafy vegetables used by the local people to boost body immunity in children, pregnant mothers (PM) and People living with HIV/AIDS (PLWA)

Scientific name	English name	Local name	County in which local name is used:	Used by:
<i>Amaranthus dubius</i>	Amaranth	Libokoi (Mchicha) Kiswenya/Mchicha	Kakamega Kilifi	Children, PM, PLWA
<i>Asystasiagangetica</i>	Chinese violet	Tsimboka	Kakamega	PM, PLWA
<i>Basella alba</i>	Indian spinach	Tsinderema	Kakamega	Children, PM
<i>Celosia trigyna</i>	Silver spinach	Chibwada	Kilifi	PLWA
<i>Cleome gynandra</i>	Spider plant	Tsisaka/Lisaka Mgagani	Kakamega Kilifi	PM, PLWA
<i>Chenopodium murale</i>	Nettle-leaved Goosefoot	Chitsambare	Kilifi	Children
<i>Corchorus solitorius</i>	Jute mallow	Murere/Omurere	Kakamega	Children, PM
<i>Cucurbita maxima</i>	Pumpkin	Sebebe/Lisebebe Tsatsatsa/ Majanimtango	Kakamega Kilifi	Children, PLWA
<i>Launaeacornuta</i>	Wild lettuce	Mutsunga	Kilifi	Children, PM, PLWA
<i>Moringa oleifera</i>	Drumstick tree	Mzungi	Kilifi	Children, PM, PLWA
<i>Solanum villosum</i>	Black nightshade	Litsutsa Mnafu	Kakamega Kilifi	PLWA
<i>Vigna unguiculata</i>	Cowpea	Likhubi	Kakamega	Children, PM, PLWA