Changing food consumption habits: A Case of African Indigenous Vegetables for Food and Nutrition Security in Kakamega County, Western Kenya

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Abstract

A number of factors contribute towards the consumption of African Indigenous Vegetables (AIVs) in Kakamega County. The significance of African Indigenous Vegetable (AIVs) in Kakamega County plays a major role in their consumption. However, some factors have been found to be constraints rather than enhancing consumption. This has increasingly led to the changing food consumption habits of AIVs in the rural households of Kakamega County. Whether these changes contribute to the nutritional benefits of consumers is an issue that needs further investigation. A study was done in order to document the preparation and cooking of spider plant (*Cleome gynandra*) and African nightshade (*Solanum scabrum*). The purpose was to determine the meal culture and consumption habits of the two AIVs in Kakamega County. Findings of the study indicate that spider plant and nightshade undergo various processes before consumption. Plucking, washing, cutting and cooking are the main steps. They are prepared each as a mixture with African kale and/or amaranthus. They are cooked by steaming or boiling and thereafter, the cook can fry and/or use additives. Both AIVs take more than one hour to prepare and cook, but spider plant takes a longer time than nightshade. There are some differences in the recipes used today to cook the two AIVs. There are a variety of foods served with AIVs. Constraints to consumption of AIVs include scarcity during dry season, time constraints for preparation, lack of skills in preparation and scarcity of fuel. This study reveals that in looking at the importance of AIVs for food and nutrition security, preparation and cooking processes are essential factors to be considered.

Key words: Recipe documentation, food and nutrition security -meal cultures

Introduction

Food consumption patterns have been changing worldwide, with a focus of improving health and accompanying health consequences at the global and regional level. (Kearney, 2010). Kenya has not been spared these consequences and is confronted with the paradoxical situation of under-nutrition and over-nutrition (FAO, 2012). For instance, the prevalence of metabolic syndrome (MS), a condition characterized by abdominal obesity, high cholesterol levels and high blood sugar is 34.6% (Kaduka *et. al* 2012). Metabolic Syndrome increases the risk for certain cancers, heart disease, stroke and diabetes. With increased incidences of these communicable diseases, some people are now becoming conscious of the type of food that they eat.

Food consumption, the type of food that people consume is affected by many factors including food availability, food accessibility and food choice, which in turn may be influenced by geography, demography, disposable income, socio-economic status, urbanization, globalization, marketing, religion, culture and consumer attitudes (Kearney 2010). In Kenya, these factors have been drivers of consumption habits, leading to adoption of exotic food in favor of indigenous ones. For centuries, different types of African

Indigenous Vegetables (AIVs) have been consumed in Kenya (Abukutsa-Onyango, 2003). The use of AIVs was part of cultural inheritance of different communities in Kenya but when exotic vegetables were introduced, people shifted their eating habits in favor of them (Abukutsa-Onyango, 2010) leading to the neglect of indigenous vegetables.

Recently, there has been concerted efforts by research organizations to revive and promote the consumption of AIVs. Studies have identified several benefits of AIVs including nutritional, health and agronomic benefits (Abukutsa-Onyango 2007b, 2010). These have been strong selling points for AIVs, thus enabling some change in eating habits in favor of AIVs. However, there is still a long way to go, as a number of impediments to this change still prevail. For sustainability to be realized, more studies such as those on indigenous knowledge, acceptability and meal cultures of AIVs need to be done beyond the past and present approaches, which mainly focused on the agronomic and nutritional characteristics.

Objectives

1. To document the processes of preparation and cooking of spider plant and African nightshade in households in Kakamega County
2. To establish the habits of consumption of AIVs
3. To determine constraints to the consumption of AIVs

Methodology

This was a qualitative study conducted in Butere and Mumias sub-counties of Kakamega County. The selection of the sample was done purposively through Rural Outreach Program-(ROP) Africa, and Sustainable Organic Farming Development Initiative (SOFDI). Both are non-governmental organizations working in the region, and they have AIV production as their flagship project. Consequently, all members affiliated to the two organizations are producers and consumers of AIVs. 16 households were sampled and participated in preparation and cooking of the AIVs. In addition, the researcher conducted 16 focus group discussions and four expert interviews. The data collection instruments included a participant observation checklist for the households, a focus group guide and an open-ended questionnaire for the expert interviews. Data were collected using participant observation for preparation, cooking, serving and eating of AIVs. In-depth focus group discussions revealed socio-economic, cultural and consumer attitudes, while expert interviews showed trends in preparation, cooking and consumption of AIVs.

Data were recorded using a video recorder, an audio recorder and a notebook. MAXQDA 12 software for qualitative data analysis was used to organize, summarize and categorize the data. The thick description was used to report the findings of the study (Ponterotto, 2006). The key findings from participant observation, focus group discussions and expert interviews were triangulated. This involved examining the consistency of the findings generated from the different sources of data for verification and for deeper understanding of the research concepts.

Findings

The study found that AIVs consumed regularly in Kakamega County were: spiderplant, nightshade, amaranthus (different species), cowpea leaves, jute mallow, slender leaf, African kale and pumpkin leaves. However, this paper will present findings for preparation, cooking and consumption of Spider plant and African nightshade only.

Results showed that spider plant and nightshade are normally cooked separately. Respondents said that they do not mix the two

because each has a distinct taste which they enjoy, and also because they do not cook for the same duration. However, each can be mixed with amaranthus and/or African kale. This is done so as to reduce bitterness, which is characteristic of the two AIVs. Mixing with amaranthus also provides tenderness in texture as well as improve flavor.

The general steps identified in the study for preparation and cooking of AIVs were: plucking (de-stalking), washing, cutting, steaming, frying and/or simmering (Table 1). Plucking involved the separation of the leaf from the stalk. The respondents said this step was necessary in order to reduce the fibrous material from the stem. From observation, it was noted that special skills were employed to de-stalk the vegetables depending on the stage of growth. The older the plant grows, the tougher the stem becomes. Thus, the more the de-stalking to eliminate the fibrous material. For the young plants, the stalks were cut in to two or three using the hands and cooked together with the leaves.

Cutting was identified as a process that was necessary for large leaves. For instance, when African kale was used, cutting must had to be done. Respondents said that since kale leaves are large, they could not mix properly with the other vegetables unless cut. Observation showed that cutting was not finely done and that it could be done with either a knife or just with the hands. For instance, one leaf of kale was cut three to four times. They acknowledged that the long duration of cooking would still make them tender and that there was no need for fine cutting.

The vegetables were then washed to remove soil and other foreign matter. Plenty of water was needed for this process as it had to be done a minimum of three times. This was observed in all households. One expert interviewee said that she did not wash her vegetables. Instead, she puts them in the sun for about 30 minutes and then shakes off soil and other foreign matter. She argued that washing usually soaks the vegetables, which alters the flavor after cooking.

The study found out that spider plant and nightshade were cooked by steaming (Table 1). To do this, older people use an earthen pot, covered with a banana leaf and a plate. The reason given for use of a pot is that pots retain heat and can cook slowly and for a long time. A pot also prevents escape of moisture and traps in the flavor. In the focus group discussions, it was revealed that aluminum pans were also used for steaming in the absence of a pot and were preferred by the younger people who said that pots usually break easily. In the steaming process, AIVs were cooked while covered tightly, throughout the process.

After steaming, frying was done using cooking oil, tomatoes and onion. This was observed with all respondents. Thereafter, fresh milk and cream were added and vegetables simmered for 10 minutes. Also mentioned in focus group discussions was that traditional ghee can be used as an additive. These three were the universal additives for nightshade and spider plant in this community. Reason given for frying was that it makes AIVs tastier. Two key informants said that they did not fry their vegetables. Reasons given included: frying alters flavor of AIVs, frying contributes to obesity and weakening of the immune system of the body and that good quality oil was too expensive to afford. Therefore, this step was optional.

Table 1 summarizes the preparation and cooking methods for spider plant and nightshade in Kakamega County.

Table 1: Recipes of Spider plant and African nightshade in Kakamega County

Type of AIV	Requirements	Preparation method	Changes observed	Duration
Spiderplant	3 bunches Spiderplant 1 bunch Amaranthus 1 bunch African kale Cooking oil Tomatoes Onions Fresh Milk or cream	Pluck the vegetables and mix them Wash vegetables 3-4 times with plenty of water Place vegetables in a pot. Add ab. ½ litre of water Cover with clean banana leaf Cover with a lid Steam for 45 minutes without uncovering Fry onion in the oil until brown, add tomatoes. Fry the tomatoes until they become very soft. Add the vegetables and mix well. Add milk or cream and cook for 10 minutes. Vegetables are ready to serve	The color of washing water turned green, and this intensified with each wash. As vegetables began to boil, there was a "bitter" smell. This changed to a savory smell. The color also changed from bright green of the raw leaf to brown color after cooking	Plucking- 30 minutes Washing- 15 minutes Boiling-45 minutes Simmering-10minutes Total duration of preparation and cooking-1hour 40 minutes
African Nightshade	3 bunches Nightshade 1 bunch Amaranthus 1 bunch African kale Cooking oil Tomatoes Onions Fresh Milk or cream	Pluck the vegetables Cut the African kale Wash vegetables three times with plenty of water Place vegetables in a pot. Add ab. ½ litre of water Cover with banana leaves and a plate Boil for 35 minutes Fry onion in the oil until brown add tomatoes. Fry the tomatoes until they become very soft. Add the vegetables and mix well. Add milk or cream and cook for 10 minutes. Vegetables are ready to serve	As above, except that the washing water had more color intensity	Plucking- 30 minutes Washing- 15 minutes Boiling- 35 minutes Simmering-15 minutes Total duration of preparation and cooking-1hour 35minutes

Table 1 shows the steps that spider plant and nightshade undergo before they are consumed. Generally, the quantities of the two AIVs and how they are mixed are as shown (Table 1). The quantity of oil used, and the number of tomatoes and onions were not standardized as this depended on individual taste and the amount of money to buy them. The time used for plucking was dependent on the amount of AIVs, the skill of the person plucking and the number of helping hands. The larger the quantity of AIVs, the longer the plucking time,

the more skilled the person, the faster the process; and the more the number of people plucking, the faster the process. For these reasons, consumers preferred to make plucking a collective activity where women were assisted by others or by their girl-children to pluck the AIVs.

The study revealed that the steaming of AIVs was done under low heat. Once the vegetables were brought to boil, the amount of firewood was reduced. The firewood used were large pieces that could burn on their own for 10 minutes or longer without monitoring. Respondents said that the steaming of spider plant and nightshade should not be "hurried up" because they will not cook properly and that they will lose their flavor. One expert said that she left her AIVs to steam overnight in a pot because there was no hurry so they cooked better. In the morning, she would find them well steamed and she would just fry them. In such a case, cooking time could not be determined. Generally, well-steamed AIVs were described as having turned "brown".

Table 1 also shows that preparation and cooking of spider plant took a longer duration as compared to nightshade. This showed that when cooking spider plant, more resources such as time and fuel may be needed as compared to cooking of nightshade. However, this did not hinder most households from consuming spider plant as compared to nightshade. Authors' conceptualized diagram summarizing the processes of preparation and cooking of AIVs is shown in Figure 1.

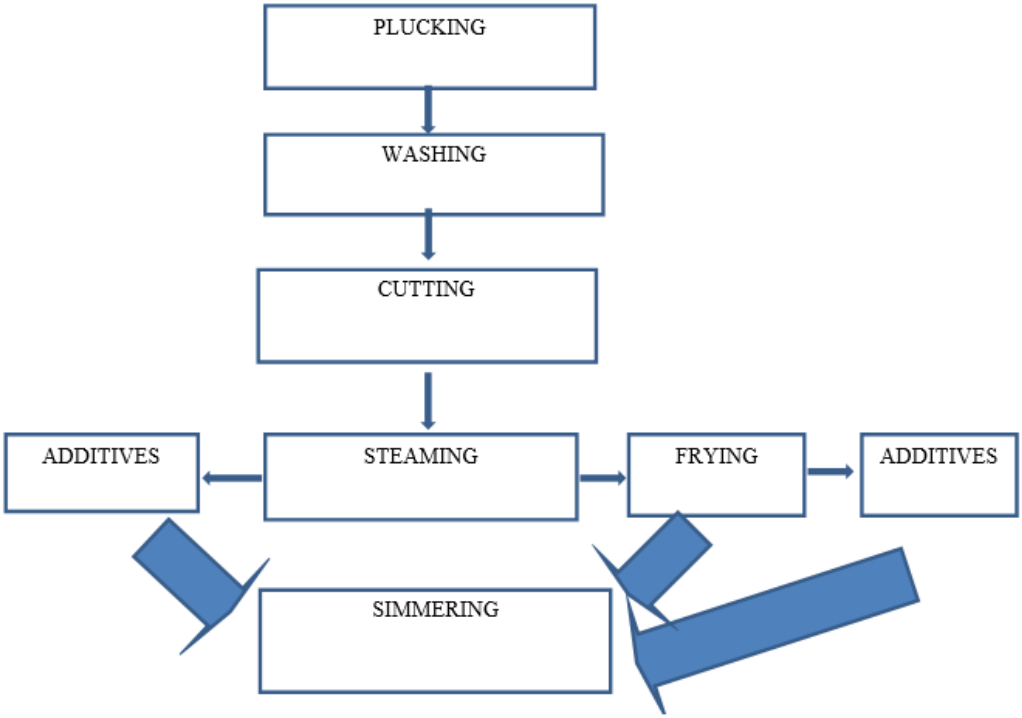

Figure 1: Steps in preparation and cooking of AIVs (Own conceptualization)

Figure 1 shows that there are 6 main steps in the preparation and cooking of spider plant and nightshade: plucking, washing, cutting, steaming, frying/additives and simmering. The first 3 steps were applicable to all respondents except one expert interviewee. Major departure was after the fourth step, where some respondents fried their AIVs while others did not. Those who did not fry were mainly respondents in the focus groups. This

showed that there were changes in the preparation and cooking of some AIVs in Kakamega County which could in turn influence consumption. At the same step, others used additives while others did not. The last step was applied by all respondents who fried and or used additives in their recipes.

The researcher further investigated consumption of AIVs at household level. It was found that the two AIVs were eaten with a starchy staple, mostly *ugali*. In this community, *ugali* was referred to as "food" because it was a favorite staple. From observation, all the households prepared *ugali* and served with the AIVs. However, focus group discussions and expert interviews revealed that AIVs also accompanied other starches such as cooked cassava, sweet potatoes, green bananas, arrow roots and "*omushenye*" (a mixture of sweet potatoes, beans and other legumes that are locally found). These were not observed in any of the household where the recipes were documented.

African nightshade and spider plant were known as "glorified" AIVs, meaning that they were used during special occasions. During such occasions, special preparation treatments were given to these vegetables, including fermentation and addition of ghee. Expert interviews revealed that such vegetables, in the past, were not fried with cooking oil. They were prepared by steaming only and then fermented with milk for several days. Ghee if available could be added to further enrich the recipe.

The study further identified the following constraints to consumption of AIVs in Kakamega County: scarcity during dry season, time constraints for preparation, lack of skills in preparation and scarcity of fuel. During the dry season, spider plant and nightshade become very scarce. Only farmers who have land by the streams can grow them and they sell very expensively. Thus, most consumers cannot afford. Time constraints were experienced especially by women who have small businesses or are in employment, while lack of skills was experienced by younger women (35 years and below). Fuel was an issue of concern among all respondents. They said that they used firewood for cooking and that the two AIVs required a lot of firewood to cook properly. Presently, there were no forests to collect firewood from. Unless one plants their own trees for firewood, they would have to buy from the market, which is expensive and not sustainable.

Generally, the study found out that the consumption of Spider plant and African nightshade was regular in Kakamega County. The regularity was affected by seasonality. The local people had their ways of preparing and cooking the AIVs (recipes) and that there were some variations in the methods used today. The variations could be attributed mainly to age differences and to modernity. Consumption of AIVs was part of the meal cultures of the respondents and these were passed on from generation to generation. It is mainly for this reason that consumption of AIVs in this community has been sustained despite the changes in recipes.

Discussion

Preparation, cooking and consumption of AIVs: their role in food and nutrition security

AIVs play a pivotal role in food security and nutrition of people in western Kenya. For many years, many species of AIVs have been consumed, initially gathered from the wild and now cultivated (Abukutsa-Onyango, 2010a). The culinary art of preparation and cooking of AIVs has been passed on from one generation to another, mainly from older women to the girl child. Findings from this study showed

that there is no known AIV that is consumed raw (as food). All AIVs have to be cooked for duration of time (see table 1).

Research has consistently documented that AIVs have high content of nutrients (and phytochemicals) important for health (Abukutsa-Onyango 2010a, Abukutsa 2007, Musotsi *et. al.* 2005). However, long periods of preparation and cooking (as observed in the study) may have an effect on the nutrients and phytochemical component of AIVs. According to Shackleton *et. al*., (2009), the potential contribution of plant foods to micronutrient status depends upon the retention of the nutrients after processing and cooking. During washing of AIVs as one of the processes documented, it was observed that the water increasingly turned green (Table 1), indicating that leaching had occurred. Leaching leads to loss of water soluble vitamins B-complex and vitamin C as well as phenolic compounds (Shackleton *e.t al*, 2009, Rickman *et. al*, 2007, Lean 2006).

Hence, while the nutritive and phytochemical value of raw leaf of AIVs has been used to promote them, it is necessary that determination of these bioactive components be done after cooking to determine whether the recipes used in Kakamega County contribute towards nutrient security.

Frying is one of the steps in cooking of AIVs. The study revealed that during frying, the water that remains in the vegetables during steaming is drained out and discarded. The researcher observed two respondents who washed the cooked nightshade with clean water before frying. It was argued by the respondents that the water, if included in the vegetables during frying, will contribute to bitterness of the recipe. While this may be a common practice in some households, it has a negative effect on the health and nutrition of the consumers. Lean (2006) argues that the use of large quantity of water in cooking can destroy vitamins, minerals and phytochemicals in AIVs thus leading to loss of useful micronutrients and phytochemicals through leaching, oxidation, damage to cellular cells and spoilage. A study done by Wakhanu (2014) also noted that there is some evidence that boiling induces losses of 5% to 15% phytates, a phytochemical that confers health benefits. There is need to further investigate the effect of cooking AIVs in large quantities of water and discarding the excess amount of water.

Fresh milk was found to be the commonest additive to the cooked AIVs, with or without frying. Apart from adding flavor to the freshly cooked recipes, milk was also used to preserve. Because of the laborious work involved in preparation of spider plant and nightshade, respondents in focus groups as well as expert interviews, indicated that the vegetables were cooked in bulk. Since a majority of households did not own refrigerators, they kept the AIVs fresh by adding milk every morning and re-heating. Such vegetables could be eaten a whole week. This process of fermenting cooked spider plant and nightshade was also used to enhance taste as some respondents observed:
"I don't know what it is about AIVs that have "slept" for at least two days. If you want to enjoy these vegetables, keep adding milk and re-heating for at least two days. Do not eat them freshly cooked" (Expert interviewee, Kakamega)

This process ensures that households have regular meals thus contributing to food security. Availability of cooked vegetables made it easy for the women to cook *ugali*, because it reduced the number of tasks to be performed. While fermentation may ensure availability of a meal, the nutritional benefits of fermented AIVs need to be investigated.

AIVs were not eaten alone but as an accompaniment to various starches. This was found to be beneficial because it alleviated monotony of foods within a household by providing variety. Food variety has an influence on nutritional status of individuals. A study conducted by Hatloy *et. al* (2000) found that there is an association between food variety and nutritional status of children. Hence, children with a high food variety score had better nutritional status as compared to those with a low nutritional status (Hatloy et. al (2000). In Kakamega, it was noted that *ugali* was mostly prepared at supper time while the other starches such as sweet potatoes, cassava and yams were prepared at lunch time. Kimiywe *et. al* (2007) also found that AIVs were consumed as relish accompanying staples such as *ugali (*maize meal), rice, maize and legumes or *chapatti* in urban and peri-urban households in Nairobi. This variety of starchy staples combined with vegetables contributed not only energy but vitamins and minerals essential for health.

Spider plant and nightshade were not only consumed within the household but had a special attachment to the cultural events of the Kakamega people. "*Eliani lya oluyali*" or "glorified" vegetables as they were sometimes referred to are AIVs that were specially prepared and can be served during important functions such as dowry payment and weddings. In western Kenya, the in-laws were treated with a lot of respect and reverence and so "glorified" vegetables were served to them. The preparation of such a recipe was different from the ordinary recipe eaten on a day to day basis. This was seen to help give a cultural attachment to the AIVs.

Constraints to consumption of AIVs

Accessibility of AIVs was found to be arduous during drought because many households did not have AIVs in their home gardens. AIVs were also expensive to buy from the market as prices escalated. Further, the commercialization of AIVs had greatly affected prices at the local markets, since AIVs are not produced on large scale (Abukutsa-Onyango, 2010). Inaccessibility to AIVs and the high market prices led to a decrease in consumption as most households opted for cheaper and more available foods. This had a negative effect on consumption of AIVs.

The research found out that there were people who did not have "proper" skills in preparation and cooking of AIVs. Respondents in focus groups and all experts noted that because children were in school for a long period of time, it was difficult to transfer the skills in cooking of AIVs to them. The knowledge on preparation and cooking of AIVs -was largely indigenous, since there were very few other channels through which it was transmitted. As a result, some of the younger women were said not to know how to cook AIVs well. This constraint was seen as a threat to consumption of AIVs especially in the young generation, where most of them complain of bitter taste. Abukutsa (2010) and Msuya (2011) noted that lack of standardized recipes were a hindrance to consumption of AIVs. With modern technology that has facilitated knowledge transfer, if standardized recipes were developed for AIVs, they can be shared on internet, mass media and print media in order to educate those who may not know how to cook AIVs.

The scarcity of fuel was highlighted as hindering consumption of AIVs especially spider plant and nightshade. Since these cook for a long period of time, a lot of fuel is needed. In Kakamega, fuel wood is commonly used while charcoal is occasionally used. Due to deforestation, there are no longer trees to harvest for fuel. This is consistent with the findings of Sikei *et. al*. (2013) who noted that a majority of households in Kakamega were suffering shortage of fuel and had to plant their

own trees for fuel wood. According to FAO (2015), fuel scarcity has led to foods with shorter cooking times being substituted for those with longer cooking times. This could impact negatively on the consumption of AIVs in Kakamega.

Conclusion and recommendations

The findings from the study reveal that in Kakamega County, spider plant and African nightshade are part of the meal cultures of the local people. They have been consumed for a long time and form the basis of the diet of the people, as some respondents said;

"*We can never get tired of them. They are our vegetables that we have known since childhood. They are part of our diet and so they are part of our lives. We can never stop eating them"* (Respondents, focus group discussion Kakamega)

This shows that the local people not only had indigenous knowledge on AIVs but were willing and able to pass it on to the next generation.

For the AIVs to be ready for consumption, various processes have to be undertaken. These processes need to be taken in to account when addressing the relationship between AIVs and food and nutrition security because of the paradoxical nature of the outcomes. For instance, while proper washing eliminates dust and stone matter, it causes leaching; cooking for a long time reduces bitterness but leads to loss of essential nutrients and phytochemicals. Therefore, the researcher recommends the following:

1. Since AIVs are important components of diet in Kakamega County, sustainability of production year round is essential
2. Further research to determine the optimal level of retention of nutrients during preparation and cooking
3. Formulation of improved recipes for AIVs and dissemination of the knowledge
4. Innovative ways of fuel acquisition in order to reduce over-reliance on fuel wood, which is now scarce

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References

Abukutsa-Onyango M 2007a, *The diversity of cultivated African leafy vegetables in three communities in western Kenya,* African Journal of Food Agriculture Nutrition and Development (AJFAND), 7(3)

Abukutsa-Onyango M 2007b, *Seed production and support systems for African leafy Vegetables in three communities in western Kenya.* African Journal of Food Agriculture, Nutrition and Development (AJFAND) 7 (3)

Abukutsa-Onyango M 2010, *Strategic repositioning of African Indigenous Vegetables in the Horticulture Sector,* Second RUFORUM Biennial Meeting held on 20-24th Sept 2010 Entebbe, Uganda.

FAO, *The impact of fuel wood scarcity on dietary patterns*: hypotheses for research. Rome (2015)

FAO, *The state of food insecurity in the world*; economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition. Rome (2012) 8-12, 23-27, 46-47.

Hatloy A, Hallund J, Diarra MM, & Oshaug A: *Food variety, socioeconomic status and nutritional status in urban and rural areas in Koutiala (Mali).* Public health Nutrition (2000) March 3(1): 57-65

Hyder A.A, Maman S, Nyoni J.E, Khasiani S.A, Teoh N, Premiji Z, & Sohani S: *The pervasive triad of food security, gender inequity and women health: Exploratory research from sub-Saharan Africa.* African Health Sciences (2005), 5 (4) 328-334

Kaduka L.U, Kombe Y, Kenya E, Kuria E, Bore J.K, Bukania Z.M & Mwangi M; *Prevalence of Metabolic Syndrome among Urban population in Kenya,* Diabetes Care, (2012) 35 (4) 887-890.

Kearney J: *Food consumption trends and drivers*. Philosophical Transitions of the Royal Society B (2010) 365, 2793–2807

Kimiywe J, Waudo J, Mbithe D & Maundu P: *Utilization and Medicinal Value of Indigenous Leafy Vegetables Consumed in Urban and Peri-Urban Nairobi***.** African Journal of Food Agriculture Nutrition and Development (2007), 7, (4),

Lean M. E. J 2006, *Food Science, Nutrition and Health*. 7th Edition. Hodder Arnold, Hachette Livre

Msuya JM: *Promoting the production and consumption of indigenous vegetables: Experiences from 'Recipes for success' Project in Tanzania.* Promotion of Fruit and Vegetables for Health African Regional Workshop (PROFAV 2011).www.fao.org>agphome>WHO>Arusha

Musotsi A. A, Sigot A. J & Abukutsa-Onyango M. O, 2005, *African indigenous vegetables recipe documentation and their role in food security*, in Proceedings of the third workshop on Sustainable Horticultural Production in the tropics, 26th to 29th November 2003, Maseno University (MSU) Editor: Abukutsa-Onyango M. O. A

Oniang'o R.K, Mutuku J.M & Malaba S: *Contemporary African food habits and their nutritional and health implications.* Asia Pacific Journal of Clinical Nutrition (2003) 12 (3) 331-336

Ponterotto J.G: *Brief note on the Origins, Evolution and Meaning of the Qualitative Research Concept "Thick Description".* The Qualitative Report (2006), 11 (3), 538-549

Rickman C. J, Barrett M. D & Bruhn M. C; *Nutritional comparison of fresh, frozen and canned fruits and vegetables. Part 1. Vitamins C and B and phenolic compounds*. Journal of the Science of Food and Agriculture (2007) 87 930-944

Shackleton M. C, Pasquini V. M & Drescher W. A 2009, *African Indigenous Vegetables in Urban Agriculture* UK & USA, Earthsac

Sikei G; Mburu J; LJ 2013, *Rural households' response to fuel wood scarcity around Kakamega forest, western Kenya.* http/www/uonbi.ac.ke

Teherani-Krönner P. and Hamburger B. (ed.). 2014. *Mahlzeitenpolitik: Zur Kulturökologie von Ernährung und Gender.* München: oekom.

Wakhanu J. A (2014), *Levels of selected antinutrients, vitamins and minerals in African Indigenous Vegetables recipes in Vihiga County of Western Kenya.* MSc. (Analytical Applied Chemistry) thesis. Kenyatta University