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DIVERSITY AND IMMUNE BOOSTING CLAIMS OF SOME AFRICAN INDIGENOUS LEAFY VEGETABLES IN WESTERN KENYA

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ABSTRACT

A survey was carried out to document the diversity and immune boosting claims of African indigenous leafy vegetables (AILVs) in Western Kenya. Both qualitative and quantitative methods of data collection were used. The results showed that there is diversity of AILVs in the study area with nine popular and frequently consumed, but cassava leaves, stinging nettle and russian comfry are not popular. Seven of these are cultivated but two, stinging nettle (*Urtica massaica*) and vine spinach (*Basella alba*) grow wildly. The AILVs are cultivated at subsistence level on home gardens with minimal inputs and only excess of this is sold. The religion one belonged to was significant ($p<0.05$) in determining consumption or not of some of the vegetables. The vegetables are rain fed and the process of harvesting is by first uprooting during thinning followed by breaking the main stem and finally plucking off the leaves with maturity. Vegetable preparation in most households was mainly by women. The elderly women were keen in this process and spent more time in preparing the vegetables which were believed to be 'nutritious'. There was no processing and preservation of the AILVs for use during the dry season. The communities rely on wild weeds during such seasons. The AILVs though consumed for good nutrition are also associated with various medicinal and immune boosting claims. Out of the nine, five are known for various health benefits, African nightshade and spider plant for good nutrition by 31.8% and 25.1% of the respondents, respectively, slender leaf for healing power by 34%, cowpea leaves and slender leaf for anti-aging by 50% and 43.8%, respectively, and cowpea leaves (43.6%) and amaranthus (53%) for smooth skin and adding blood, respectively. Chi square analysis indicated that African night shade, spider plant and amaranthus are statistically significant ($p<0.05$) in contributing to good nutrition, healthy functioning of the body and immune boosting. Further analysis showed that spider plant and amaranthus are significant ($p<0.05$) for immune boosting.

Key words: indigenous vegetables, diversity, immune boosting

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INTRODUCTION

The definition of vegetables varies from culture to culture depending on food selection and preparation [1]. Different vegetables have different edible parts, for example flower buds (broccoli, cauliflower), seeds (peas, sweet corn), leaf sheaths (leeks), leaves (kales, cabbage), buds (brussels, sprouts), stems of shoots (ginger, asparagus) and bulbs (onions, garlic) among others [2]. Vegetables contain vitamins and minerals known for immune boosting including calcium, magnesium, manganese, selenium, zinc, copper, iron, and vitamins A, C, E and B6 [3].

There are about 800 to 1000 species of edible leafy vegetables in Sub-Saharan Africa referred to as indigenous, although only a small percentage of these are utilized as food [4]. The high diversity of these vegetables shows their importance in adaptation to the environment and consumer preference.

Indigenous vegetables have been used as a side food with the staples in the African culture for a long time and have been an integral part of agricultural systems [5]. They have been an important contributor to micronutrient intake and food and nutrition security at large. Production of indigenous vegetables does not require high amounts of resources such as fertilizer and pesticides. In fact when resources are limited, farmers use indigenous vegetables both to meet their food and nutrition security as well as improve the soil structure [6]. Indigenous vegetables have with time however, been neglected and under-utilized, considered old- fashioned, poor man's food and therefore shameful to consume [7]. Little is therefore known about them and are threatened with genetic erosion due to change in land use and eating habits [8].

In Kenya, vegetables are either exotic or indigenous. Exotic vegetables are those which have recently been introduced such as cabbages, carrots and spinach. Indigenous vegetables, on the other hand, are either those which were originally in an area [9] or introduced and have been used over a long period of time until they form part of the culture and tradition of a community [10]. The indigenous vegetables include night shade (*solanum* spp.), spider plant (*cleome* spp.), amaranthus (*amaranthus* spp.), cowpea (*vigna* spp.), sweet potato leaves (*lpomeas* spp.), pumpkin leaves (*cucurbita* spp.), jute mallow (*corchorus* spp.) and cassava leaves (*manihot esculenta*) [11].

Western Kenya is known for its high consumption of AILVs for a long time [12]. This practice is passed on from generation to generation. Most people start consuming AILVs from childhood and only realize their health benefits later in life. The AILVs in this region are therefore very diverse. According to a survey conducted between January 2002 and March 2003 in six districts of Nyanza and Western provinces, ten AILVs representing eight botanical families were found [12].

African indigenous leafy vegetables (AILVs) in the past have widely been underutilized and neglected in research, breeding and modern production methods [8]. They have, however, received a lot of interest in the recent past due to their

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contribution to food and nutrition security and have also been regarded as having medicinal and immune boosting values [11,12,13]. Despite the interest however, their cultivation is still subsistent and traditional where only minimal inputs are used.

The main objective of this study was to document the diversity of AILVs and their immune boosting claims in the study area.

MATERIALS AND METHODS

The study used both qualitative and quantitative methods of data collection. A pretested structured questionnaire was administered to 420 respondents (sample size calculated using Fisher *et al*. [14] formula with an allowance of about 10% attrition rate). Themes of interest to this study, immune boosting claims on AILVs, were developed and used for discussion in 4 focus group discussions and 10 key informant interviews. Two enumerators were recruited and trained on data collection and ethics on fieldwork. They then translated the questionnaire and themes of discussion into appropriate languages with the guidance of the principal researcher.

The respondents were drawn from 4 locations in the Maseno division of, Kisumu West district. The transect method of sampling [15] was used to have representation of the location. In this, the centre of each of the sub-locations in the four locations of the division was identified and representative respondents interviewed towards the four corners opposite each other. A randomized cluster sampling method [14] was used to identify the respondents to include households who grow and consume AILVs, those who grow and sell, those who buy and consume and those who sell but do not consume. These groupings were realized during the pretesting of the tools.

Five AILVs popular in the area in terms of production, consumption and association with different medicinal and immune boosting claims by majority of the respondents across the division were photographed and used during four (one per location) focus group discussions. Proportionate piling method [15] was used to 'rank' the five vegetables as per the claims. The 5 vegetables were spider plant (*Gynandropsis gynandra*), amaranthus (*Amaranthus hybridus*), African night shade (S*olanum nigrum*), slender leaf (C*rotalaria brevidens*) and cowpea leaves (V*igna unguiculata*).

Proportionate piling method shows relative shares of things to be compared in this case comparing the contribution of the 5 AILVs to the three health claims. It also enhances participation and facilitates decision making. The focus group participants were taken through a step by step presentation of how the tool works in detail. The three main heath claims; immune boosting, healing power and adding blood, teased out of the focus group discussions (FGD) were subjected to the tool. This tool was introduced in the middle of the discussion to probe additional responses and to get the relative importance of the three health claims associated with the five AILVs.

The focus group discussion participants ranged between eight and fifteen and sat in a circle and the photographs of the 5 AILVs put in the middle. One hundred (100) bean

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seeds were provided and the participants encouraged to each pile them on the photographs, the number of bean seeds indicating the importance of the vegetable in contributing to the health claims [15]. The higher the number of bean seeds on a vegetable photograph, the better the contribution to the health claim in question. After all the 100 bean seeds were distributed among the photographs for a health claim, they were then collected and counted and the 5 AILVs ranked. The seeds were again distributed among the photographs of the 5 AILVs when discussing another health claim as per the communities' understanding. This process was repeated until all the health claims were exhausted.

Though this method is very quick and simple, it is subjective and can only be used to rank in terms of first, second or third. In cases where there was overwhelming association of a health claim to an AILV, all the bean seeds were piled on the photograph of the said vegetable by different FGD participants. This was seen in 'adding blood' for amaranthas in two locations and healing power for slender leaf in all the four locations.

Individual discussions were held with the 10 key informants drawn from Agricultural officers, farmers, traders and promoters of AILVs to get an insight into the key issues coming out of the survey.

RESULTS

The ages of the respondents ranged from 15 to 103 years (Table 1). The majority were below 50 years (77%). They were either Luo or Luhya by tribe with Luo in majority (85.5%). Most of them were farmers (82.6%) and had attained primary level of education (72.1%). Most of the respondents were married and monogamous marital status was the most common (58.4%). They belonged to various religious groups but especially Hera (22.4%), Apostolic (21.7%), Catholic (16.3%) and Anglican (14.2%). A few belonged to Roho (9.8%), Nomia (9.5%), Legio (3.3%), Israel (2.6%) and Muslim (0.2%).

A chi square test showed that religion is significantly important in AILVs consumption ($p<0.05$), while age, tribe, occupation and education level of the respondents were not significant ($p>0.05$).

Diversity of African indigenous leafy vegetables consumed in the study area

Almost all (99.8%) the respondents indicated that they had heard of AILVs. They were able to list nine AILVs as shown in Table 2. Out of these, five AILVs were well-known by majority of the respondents, spider plant (98.6%), slender leaf (98.1%), African night shade (97.1%), cowpea leaves (97.1%) and amaranthus (92.1%). The least known AILV was Russian comfry, only 0.2% of the respondents had heard of it. All the respondents had heard of more than one AILV. A majority (n=415, 98.8%) of the respondents grew and consumed AILVs while some grew, consumed and sold them (n=273, 65%).

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Table 3 shows the distribution of study respondents by the vegetables they reported to consume. A majority of the respondents consumed five AILVs, slender leaf (94.5%), African night shade (94.3%), cowpea leaves (91.2%), spider plant (91.2%) and amaranthus (77.6%). Only one (0.2%) respondent reported to consume Russian comfry.

The majority of the respondents obtained advice on the consumption of the indigenous vegetables from their parents (94.4%) as shown in Figure 1. Other sources of advice included health workers, extension workers, neighbors, friends and the media (radio, print and television).

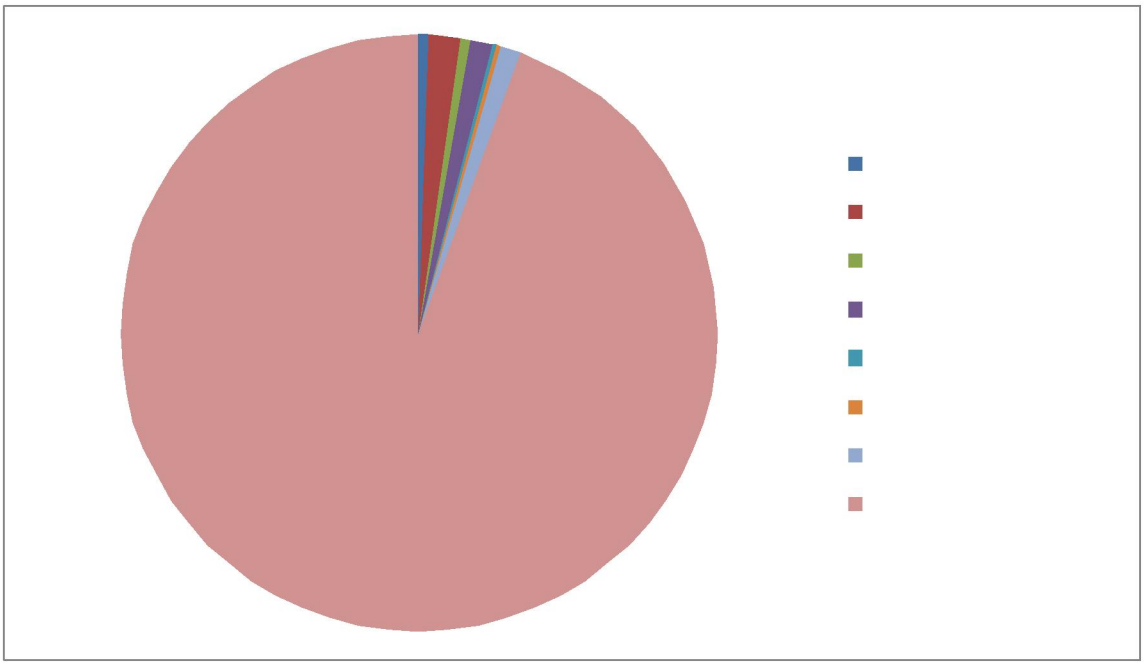

Figure 1: Percent distribution of AILV consumers by source of advice on consumption

Immune boosting claims

Table 4 shows the percent distribution of the respondents by health benefits they said were associated with the various AILVs. The five AILVs consumed by a majority of respondents were associated with different health benefits. Many respondents said African night shade and spider plant were associated with good nutrition, 31.8% and 25.1%, respectively. Slender leaf was, however, associated with having healing power by 34% of the respondents and cowpea leaves and slender leaf associated with anti-aging properties by 50% and 43.8% of the respondents respectively. Most respondents associated cowpea leaves (43.6%) and amaranthus (53%) with smooth skin and "adding blood", respectively. Association of a health benefit to an AILV was not

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exclusive of each other. Many respondents associated a health benefit to more than one vegetable.

A test statistic, chi-square, was used to decide on the ranking of the nine AILVs (Table 4) as per health benefits. It emerged that amaranthus (*Amaranthus hybridus*), African night shade (*Solanum nigrum*) and spider plant (*Gynandropsis gynandra*) were statistically significant ($p<0.05$) in contributing to immune boosting, good nutrition and healthy functioning of the body. Further analysis indicated that amaranthus and spider plant were statistically significant ($p<0.05$) in contributing to immune boosting.

Although a majority of the respondents (86%) heard of AILVs from their parents, information on the benefits of these vegetables was mainly received from the health facility (54.5%) and only 22.5% from parents as shown in Figure 2. The other sources of information on benefits and general awareness of AILVs were extension workers, social workers, school and the media.

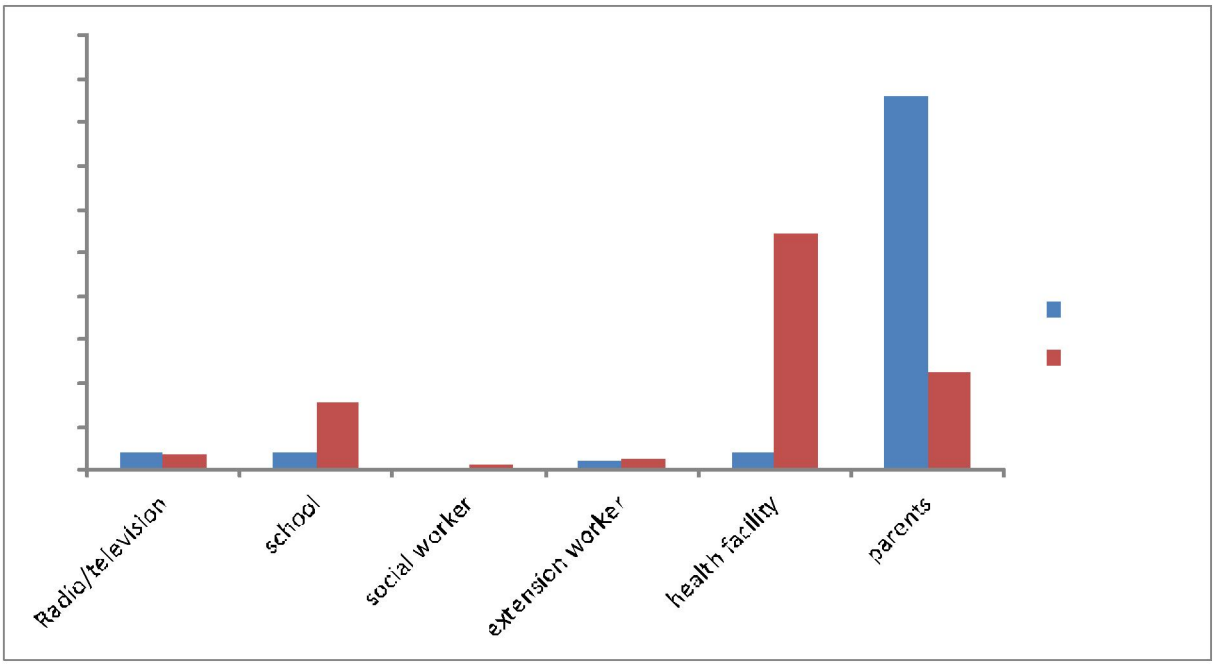

Figure 2: Percent contribution of different sources of information on AILVs awareness and benefits

A majority of the respondents felt changes after consuming AILVs (Figure 3). The type of changes were strong immunity (676) which was 73.3% of the respondents and rejuvenated (233) which was 25.3% of the respondents. Someone else known to the respondent also felt similar changes, 627 (73.4%) for strong immunity and 200 (23.4%) for rejuvenated. Those who did not feel any changes were very few for both the respondents and someone else known to them.

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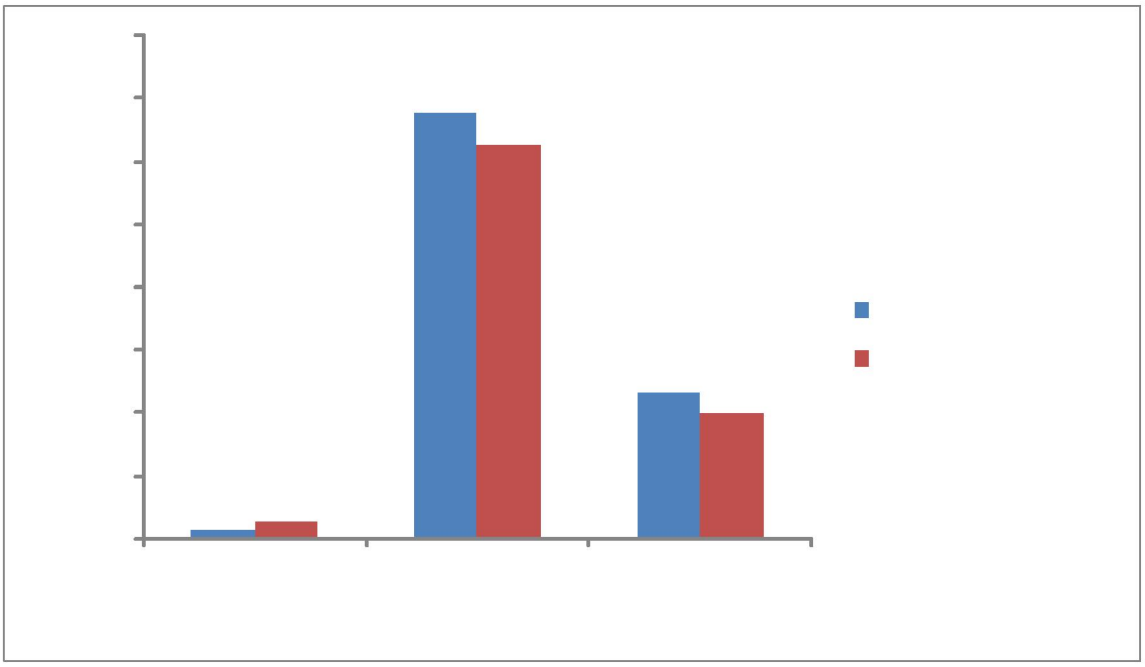

Figure 3: Types of changes felt after consuming AILVs

Information from the four focus group discussions (Table 5), one held in each location, gave an indication of how the five main AILVs were associated with immune boosting, "adding blood" and healing power across the four locations. In three locations, North West Kisumu, East Seme and West Kisumu, African night shade (*Solanum nigrum*) was known for immune boosting as was shown by 30%, 58% and 49% of the bean seeds, respectively. In all four locations on the other hand, amaranthus (*Amaranthus hybridus*) was known for "adding blood" as shown by 100%, 45%, 100% and 86% of the bean seeds in Otwenya, North West Kisumu, East Seme and West Kisumu, respectively. Slender leaf (*Crotalaria spp*.) was known for having healing power (malaria and stomachache) as shown by 100% of the bean seeds in each of the four locations. There were also claims that African night shade (*Solanum nigrum*) and spider plant (*Gynandropsis gynandra*) can be used to treat ulcers and stomachache. Stinging nettle (*Urtica massaica*), though not known to many was said to be good for "adding blood" and immune boosting (12 respondents).

Information from the key informants indicated that AILVs are gaining interest in the study area especially because of the immune boosting claims. Farmers now cultivate the vegetables on kitchen gardens and more and more is finding its way into the markets. Most farmers prepare their own seed.

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DISCUSSION

Diversity of African indigenous leafy vegetables consumed in the study area

Africa is well known for its diversity of vegetables and plant species [16] especially because of the different ecosystems and vegetation zones. Only a small percentage of these species are cultivated. The fact that a vegetable in Africa is consumed as an accompaniment for the main staple has helped in biodiversity of vegetables both wild and cultivated [17].

Like Botswana, Kenya and especially the western region is endowed with a variety of AILVs like *Cleome, Amaranthus, Corchorus* and *Vigna* species and other medicinal plants. Most of them grow naturally and are plenty during the rainy seasons [12, 18]. They are better adapted to the environment because of long usage than the introduced exotic ones [19]. It was, however, noted from this study that the diversity of AILVs is declining. The older people could remember some AILVs that are extinct and no longer in use. These findings corroborate with those of van Rensburg *et al*. [20]. This problem is attributable to increased promotion and use of exotic vegetables and the negative image towards AILVs [20].

The other finding of this study was that out of the nine AILVs mostly grown and consumed, five appeared more popular in terms of production, consumption, marketing and medicinal claims. These findings are in line with those of another survey carried out in Western Kenya [12] in which these five vegetables were among the ten priority AILVs. Consumption of AILVs increases during the rainy seasons since they are normally plenty and cheap [13]. There was, however, no indication of processing and preservation of the AILVs for use during the dry season. The communities in the study area depend on wild weeds as vegetables during the dry season. These are identified by their local names as *Adongonyayuora*, *Nyadekdani*, *Okuoro* (Pappea capensis*), Atipa* (Asytasia mysorensis), *Achak* (Launaea cornuta), *Nyawendagwata, Osieko, Odielo* (Commelina Africana), *Nyabondo* (Mimusops kummel) and *Ogundu* (Sida tenuicarpa) [21]. This indicates that vegetables, which provide important nutrients to the body, are an ever present component of meals in this area.

Immune boosting claims

The two main ethnic communities in the study area, the Luo and Luhya, have been placed on agricultural and mixed farming economic systems. This kind of system encourages utilizing wild plants to increase diversity of food consumption [12]. The AILVs are associated with many health benefits but mainly immune boosting, good nutrition and healthy functioning of the body.

Vegetables contain high micronutrients that perform many functions in the body and improve the immune system. Isolated research work done on AILVs to determine their nutritional value [21, 22, 23] indicate that they have a high potential in improving the immunity of people due to their nutrient and non-nutrient bioactive properties [24]. A large number of the AILVs have been reported to have health

protecting properties and uses [13, 21, 25]. Orech *et al*. [26], on the other hand observed that some phytochemicals in some of the AILVs consumed in Western Kenya may pose toxicity problems when consumed in large quantities or over a long period of time. There is, however, not enough evidence on the toxicity of these AILVs. Proof-of-principle studies have also not been done and the active ingredients in immune boosting not isolated by any of the studies.

As indicated in the results of this study, the majority of the respondents know of AILVs at childhood from their parents (86%). Inclusion of AILVs in the diet of these communities is therefore ingrained deep into their cultures. Information on health benefits of the AILVs is mainly received from the Health facility (54.5%) and only 22.5% from parents. Education level influenced the awareness on the health benefits of AILVs from the health facilities which implies that education is a significant factor in deciding to or not to consume the AILVs.

The immune boosting, "adding blood" and healing power claims from the focus group discussions of the current study on African night shade, amaranthus and slender leaf, respectively, corroborate with the findings of a survey in Tanzania [19] and another in Nairobi Kenya [13]. It is, however, very difficult to decide which vegetable is good for immune boosting, good nutrition or healthy functioning of the body because these attributes cannot be isolated from each other and different AILVs are associated with different health benefits by different groups.

The older women seemed to be more aware of the health benefits and diversity of AILVs than the younger ones. In fact their vegetable preparation methods varied greatly and the older women put a lot of effort and time into preparing quality vegetables which are "believed" to be of a higher nutritional value than that prepared in a hurry by the younger women. These findings corroborate with those of Keding *et al.* [19] in Tanzania. The difference in vegetable preparation between the older and younger women is attributable to the problem of not being able to pass on indigenous knowledge on production, consumption, processing and preservation of AILVs from generation to generation due to modernization and urbanization [23]. Through observations, the Luhya community who formed 14.5%f of those interviewed valued the health benefits of the vegetables more than the Luo community (85.5%), though there was no significant difference between the two tribes as related to AILVs consumption ($p>0.05$). The communities thus influenced each other in AILVs consumption.

In conclusion therefore, the AILVs consumed in the study area are diverse. They are rain fed and there is no processing and preservation for use during the dry season. The communities rely on wild weeds and plants during such times. The AILVs are known for different health benefits. Amaranthus and spider plant were significant in contributing to immune boosting. Further research should be done on the two vegetables with a view to isolate the active ingredients in immune boosting.

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Table 1: Demographic data (N=420)

Variable name	Sub-variable	%
Age	15-50yrs	77
	Above 50yrs	23
Tribe	Luo	85.5
	Luhya	14.5
Occupation	Farmers	82.6
	Business	8.4
	Employed	5.9
	None	3.1
Education	Primary	72.1
	Secondary	13.3
	Never went	13.3
	College	1.2
Marital status	Monogamous	58.4
	Widowed	27.0
	Polygamous	12.7
	Separated	1.6
	Divorced	0.3
Religion	Hera	22.4
	Apostolic	21.7
	Catholic	16.3
	Anglican	14.2
	Roho	9.8
	Nomia	9.5
	Legio	3.3
	Israel	2.6
	Muslim	.2

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Table 2: Number of respondents per AILV heard of

Vegetable	No. of respondents	% of respondents
Spider plant	414	98.6
Slender leaf	412	98.1
African night shade	408	97.1
Cowpea leaves	408	97.1
Amaranthus	387	92.1
Vine spinach	31	7.4
Cassava leaves	27	6.4
Stinging nettle	12	2.9
Russian comfry	1	0.2

Table 3: Number of respondents per AILV consumed

Vegetable	No. of respondents	% of respondents
Slender leaf	397	94.5
African night shade	396	94.3
Cowpea leaves	383	91.2
Spider plant	383	91.2
Amaranthus	326	77.6
Vine spinach	89	21.2
Cassava leaves	20	4.8
Stinging nettle	12	2.9
Russian comfry	1	0.2

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Table 4: Percent distribution of respondents by health benefits associated with different AILVs[1]

Vegetable	Benefit (percent of respondents)							
	None	Good Nutrition	Immune Boosting	Healthy body function	Healing Power	Anti-aging agent	Smooth skin	Adds blood
African night shade	26.1	31.8	19.0	12.5	19.4	0	3.6	26.0
Spider plant	21.7	25.1	24.0	19.0	21.4	6.2	9.1	7.0
Amaranthus	13.0	16.1	25.3	22.0	11.3	0	7.3	53.0
Slender leaf	12.0	15.2	19.0	20.7	34.0	43.8	29.1	5.0
Cassava leaves	0	0	0	0	0	0	1.8	0
Vine spinach	1.1	0	0.5	0	0	0	0	0
Stinging nettle	0	0.2	0.5	0.3	0.4	0	5.5	0
Cowpea leaves	26.1	11.6	11.8	25.5	13.5	50.0	43.6	9.0
Russian comfry	0	0	0	0	0	0	0	0
Total	100	100	100	100	100	100	100	100

[1]Five major AILVs were mentioned for various health benefits: Cowpea leaves, Amaranthus, African night shade, Slender leaf and Spider plant.

Table 5: Distribution of 100 bean seeds per health benefit across the four locations[2]

	Immune boosting	"adding blood"	Healing power
African nightshade	8^a 30^b 58^c 49^d	0^a 0^b 0^c 0^d	0^a 0^b 0^c 0^d
Spider plant	41^a 24^b 7^c 16^d	0^a 26^b 0^c 14^d	0^a 0^b 0^c 0^d
Amaranthus	5^a 27^b 22^c 0^d	100^a 45^b 100^c 86^d	0^a 0^b 0^c 0^d
Slenderleaf	10^a 10^b 13^c 35^d	0^a 0^b 0^c 0^d	100^a 100^b 100^c 100^d
Cowpea leaves	36^a 9^b 0^c 0^d	0^a 29^b 0^c 0^d	0^a 0^b 0^c 0^d

[a]Otwenya location; [b]North West Kisumu location; [c]East Seme location; [d]West Kisumu location

[2] Amaranthus was attributed to "adding blood" and Slenderleaf to healing power in all the 4 locations. African nightshade was attributed to immune boosting in 3 of the locations.

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