

1 **Farmers’ Knowledge, Attitudes and Practices in the Production, Preservation and**
2 **Utilization of African Leafy Vegetables in Western Kenya**

3
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6
7 **Abstract**

8
9 A large diversity of African Leafy Vegetables (ALV) are grown and consumed in the western
10 region of Kenya. The vegetables include *Cleome gynandra* (spider plant or cat’s whiskers),
11 *Solanum nigrum* (black nightshade), *Cucurbita spp* (pumpkin leaves), *Vigna unguiculata*
12 (cowpea leaves), *Amaranthus spp* (pig weed), *Corchorus spp* (jute mallow), *Crotalaria*
13 *ochroleuca* (slender leaf), and *Brassica carinata* (African kale). Despite being nutritionally
14 superior to the exotic vegetables, people have neglected them in favour of the exotic
15 vegetables. This neglect, coupled with widespread poverty, poor feeding habits, and over-
16 reliance on starchy foods has ensured persistent high cases of malnutrition and micronutrient
17 deficiencies. In the recent past however, promotion of the ALV is being undertaken by various
18 organizations. In an attempt to boost the promotion of these vegetables, a study was conducted
19 with the objective of determining the farmers’ knowledge, attitudes and practices in the
20 production, preservation and utilization of African Leafy Vegetables in Kakamega and Vihiga
21 Counties, western Kenya. Twelve gender-disaggregated Focus Group Discussions were held,
22 six groups in each County. Various categories of organizations offered trainings promoting
23 ALV. Non Governmental Organizations category had the highest number in both counties.
24 ‘How to grow ALV’ was the most favourite topic delivered. There are various sources of
25 knowledge led by trainings from various organizations, and followed by family, neighbours,
26 friends and relatives. The Group participants gave 19 different ALV, which are either
27 domesticated or wild and are consumed in Western Kenya. The farmers outlined how
28 vegetables for the market and for home consumption are handled and prepared after harvesting.
29 African Leafy Vegetables which have been domesticated for long are sold as much as they are
30 home consumed, while the wild, those domesticated recently and most of the ones from plants
31 which have multiple uses are not sold. Though preservation for long periods was rare, a few
32 participants described how they processed and preserved some leafy vegetables for long
33 periods by either boiling the vegetables and draining water every day or by drying in the sun.
34 All family members consume most vegetables. However, thirteen ALV are encouraged for
35 specific individuals mostly because they are believed to have health benefits. Similarly, twelve

36 ALV are discouraged for specific individuals, mostly because of myths or some people do not
37 know how to prepare them for consumption. Various topics needed reinforcing for the
38 participants to feel well equipped. The farmers have reasonable knowledge regarding
39 production of ALV, though there is need for more training. Their attitude and practices on
40 post-harvest handling, preservation and utilization is greatly influenced by the culture.

41

42 **Keywords:** Knowledge, Attitudes, Practices, African Leafy Vegetables, Production,
43 Preservation, Utilization

44

45 INTRODUCTION

46 African Leafy Vegetables (ALV) have been consumed for many years locally. The vegetables
47 used to be collected from the wild or grew as weeds on farms. They had been edged out by the
48 coming of the exotic breeds of vegetables, despite being more nutritious. Actually, at the
49 national level, their recognition is still very low. During the 2019 Kenya Population and
50 Housing Census, no data was collected on ALV yet data was collected on a number of exotic
51 breeds of vegetables like kales, cabbages, and tomatoes. In the recent past however,
52 consumption has resumed and a number of the vegetables have been domesticated. Promotion
53 of the ALV is also being undertaken by various organizations especially in Western Kenya. To
54 encourage the promotion of these vegetables, a study was conducted with the objective of
55 determining the farmers' knowledge, attitudes and practices in the production, preservation and
56 utilization of African Leafy Vegetables in western Kenya. The research questions guiding this
57 study were:

- 58 i. What knowledge do farmers have in regard to production, preservation and utilization of
59 the African leafy vegetables?
- 60 ii. What attitudes do farmers have in regard to utilization of the African leafy vegetables?

61 iii. What practices are undertaken by farmers in the production, preservation and utilization of
62 the African leafy vegetables?

63 **Importance of African Leafy Vegetables**

64 There is more awareness of the health-enhancing properties of non-nutrient bioactive
65 compounds found in fruits and vegetables. This awareness has directed immense attention to
66 vegetables as vital components of daily diets. The focus on vegetables as critical dietary
67 components is significant, as leafy vegetables have long been indispensable ingredients in
68 traditional sauces that accompany carbohydrate staples for sub-Saharan African Populations
69 [1]. They represent quality nutrition for large segments of the population and supply most of
70 the required vitamins, especially A, B, and C, along with essential minerals, fiber,
71 carbohydrates, and proteins [2, 3]. African leafy vegetables are accessible to low-income
72 communities in rural and urban areas. This accessibility offers an opportunity of improving the
73 nutritional status of many low-income families whose health and nutrition are at risk [4; 3].
74 Unlike previously, ALV have been attracting research attention recently for their nutrition
75 quality and also for the healing power of some of them [5], yet much is yet to be achieved. It
76 is crucial to pay more attention to the preservation of these vegetables to ensure year-round
77 supply even as their utilization is being promoted.

78 Western Kenya has arable land that supports a variety of crops and is endowed with abundant
79 agricultural biodiversity. That includes ALV such as spider plant, African nightshade, pumpkin
80 leaves, cowpea leaves, amaranths, jute mallow, slender leaf, and African kale. Yet, cases of
81 malnutrition and micronutrient deficiencies remain high due to widespread poverty, poor
82 feeding habits, and over-reliance on starchy foods. Women and children are at the center of
83 nutritional deprivation owing to their increased physiological demands compounded by their
84 often-disadvantaged social status in the society [6]. Studies show that dietary diversification is

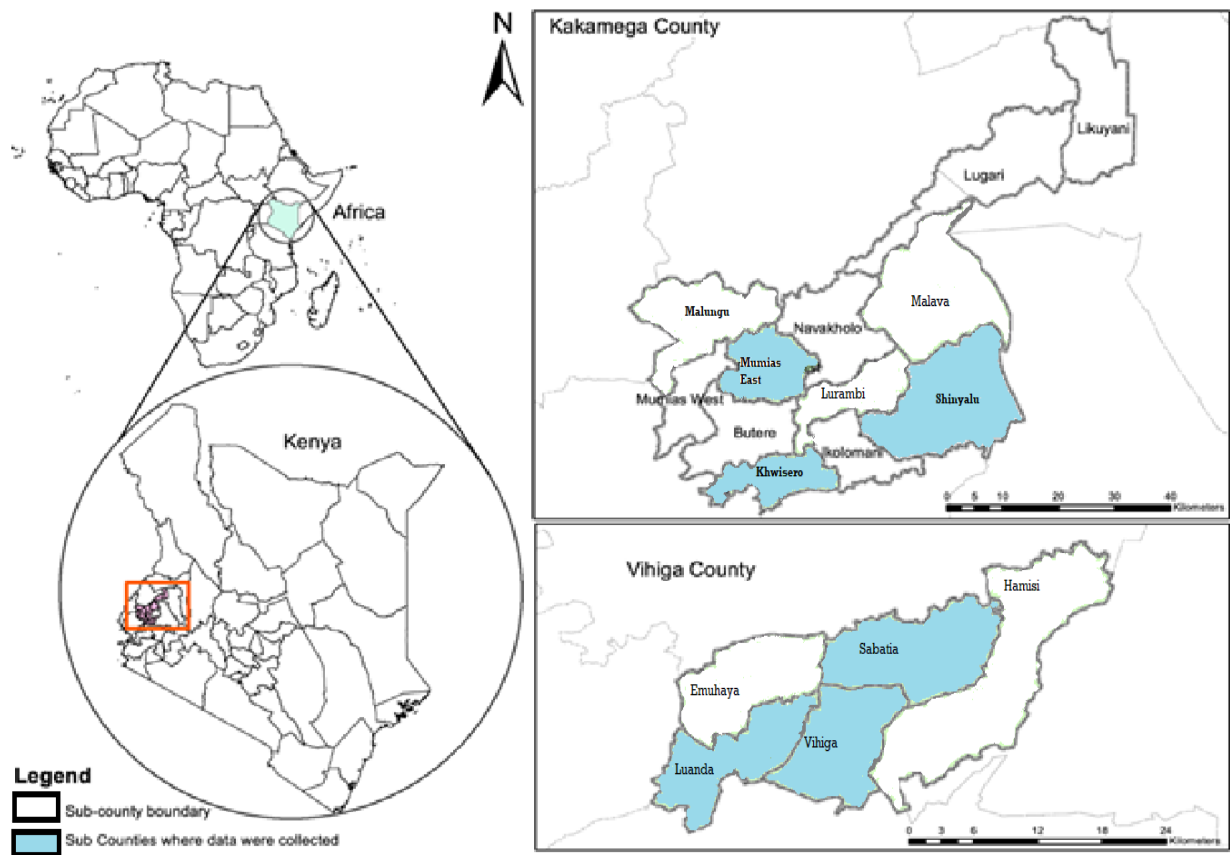
85 positively correlated with improved nutrition. Western Kenya has been described as highly rich
86 in agro-biodiversity; however, cultural and social dimensions cannot be overlooked in
87 accurately capturing or addressing food insecurity. Home-based production of diverse and
88 nutritious food is among the most direct and effective ways to address food and nutrition
89 security for resource-poor families. Still, training and knowledge dissemination plays a
90 significant role in changing cultural attitudes. [7; 8].

91 STUDY AREA AND DATA COLLECTION

92 This was a cross sectional study conducted in Kakamega and Vihiga Counties (Figure 1). The
93 counties were chosen because a large diversity of ALV are grown and consumed in western
94 region of Kenya. The study was part of the ‘Nutrition Sensitive Promotion of Vegetables –
95 Project’ whose objective was to measure and compare the impact of two different nutrition
96 messages and two different message delivery channels on the diversity of vegetable production
97 and consumption in smallholder household; which was conducted in Kakamega County. For
98 this particular study, Vihiga County was added to increase the study area to improve the quality
99 of data. The two counties cover the great Kakamega, since Vihiga was curved out of Kakamega
100 in 1990 [9].

101 Kakamega has a population of 1,867,579 and a population density of 618 persons per square
102 kilometre [10]. Rainfall is uniformly distributed throughout the year with March and July
103 receiving highest whereas December and February the least. The county has annual rainfall
104 that range from 1280.1mm to 2214.1 mm per year. Agriculture is the backbone of the county,
105 producing over 65% of the total earnings. The area under agriculture is 219,776 ha. There are
106 two main categories of crops. Food crops and industrial crops. Food crops include maize,
107 sorghum, finger millet, rice, beans, peas, grams, cassava, sweetpotato, and arrow roots.

108 Industrial crops are basically horticulture [11]. Total number of farming households are 335,
109 269.



111 **Figure 1: Map of Kakamega and Vihiga Counties in western Kenya.**

112 Source: [12] with modification.

113

114 Vihiga county has a population of 590,013 and a population density is 1047 persons per square
115 kilometre [10]. The area enjoys reasonably fertile soils and a good climate. It is sub-humid,
116 receiving on average between 1,800 and 2,000 mm of rain distributed in two rainy periods, the
117 long (March–July) and short (August–November) rains, which allow two cropping seasons per
118 year [13; 14]. Agriculture, dominated by small scale farmers, constitutes 70% of the
119 economic activities. Crop farming contributes 64% of the county's income. The area under
120 agriculture is 50,521 ha. Maize and beans are the main subsistence crops while tea and coffee
121 are the main cash crops. Other crops are sorghum, millet, cassava, sweet potatoes and bananas

122 [15]. Total number of farming households are 113, 753. Eighty five percent of the population
123 living in the county have their livelihood mainly from agricultural activities [16].

124 Focus group discussions methodology and document analyses were used to collect data. The
125 data collected was analyzed using descriptive and inferential statistics. A Focus Group
126 Discussion (FGD) is commonly defined as a method of collecting research data through
127 moderated group discussion based on the participants' perceptions, ideas, opinions, thoughts
128 and experience of a topic decided by the researcher [17; 18; 19; 20; 21]. Qualitative researchers
129 often rely on focus groups to collect data from multiple purposely selected individuals
130 simultaneously, rather than from a statistically representative sample of a broader population.
131 Focus groups are less threatening to many research participants, and this environment is helpful
132 for participants [22; 23; 24]. The method is frequently used as a qualitative approach to gain
133 an indepth understanding and exploration of social issues. Focus groups often provide much
134 data, often more quickly than would a survey. Focus group data can be used alone or in
135 conjunction with quantitative data [25; 26]. There is lack of clear, evidence-based guidance
136 about deciding on sample size when using focus group methodology in research, though most
137 focus group researchers use the group as the unit of analysis [19; 23].

138

139 The sample size for this study was 12 FGDs. For this study, it was observed that six groups per
140 county, three of each gender, were sufficient to remove bias and allow the researcher to
141 examine themes common across the groups. Literature has suggested that three to six different
142 focus groups are adequate to reach data saturation or theoretical saturation with each group
143 meeting once or multiple times [17; 19; 23]. A structured questionnaire was used to guide the
144 discussions and collect data on knowledge, production, post-harvest handling, preservation and
145 utilization of ALV.

146 Three farmer groups were randomly selected each from a different sub-county from the seven
147 sub-counties participating in the larger study in Kakamega County. The list of the farmer
148 groups in the various sub-counties had been supplied by the County Agricultural Office. For
149 the Vihiga County, three farmer groups were randomly selected each from a different sub-
150 county from the list of farmer groups supplied by the County Agricultural Office. For each
151 farmer group, all the members were invited to join the FGDs, but not all were able to attend.
152 No payments were given for attending the discussions. However, each participant was given
153 KES. 200 (2USD) as transport refund after the discussions. A pilot FGD was conducted in one
154 of the sub-counties which had not been selected in Kakamega to test the schedule and check
155 whether there were errors that needed to be rectified before its deployment.

156 On a particular day, two gender-disaggregated FDGs were held from one farmer group. It is
157 believed that men and women talk more openly when in separate groups, and there is a
158 possibility that their views are varied [27]. The meetings for women were held in the morning,
159 and for men were held in the afternoon. The local contact persons advised on a central venue
160 where the FDGs were held. The setting for each discussion was usually in a central community
161 meeting place such as a church, market ground, or in a community leader's home. Discussions
162 were held in Kiswahili, which is a common language in Western Kenya. The Focus group
163 schedule/guide was administered by the researcher and a research assistant. The researcher was
164 responsible for facilitating the discussion, prompting members to speak, requesting overly
165 talkative members to let others talk, and encouraging all the members to participate. The
166 research assistant responsibilities included recording the session by audiotape, taking notes,
167 creating an environment that was conducive for group discussion (For example; dealt with
168 latecomers, being sure everyone had a seat) and verified the data [17; 28]. Every evening, the
169 facilitator and the note-taker discussed the events of the day, listened to the audiotapes and
170 perused through the notes to re-check whether important points had been captured.

171 National Commission for Science, Technology and Innovation, Nairobi, Kenya granted the
172 Research authorization. Oral informed consent to participate in the FDG was obtained from
173 each participant by the researcher before conducting the discussions. To maintain
174 confidentiality of study participants, names of participants and/or associated identifiable data
175 were not collected. The anonymity of participants was adhered to when compiling the data
176 collected.

177

178 **Farmers' knowledge**

179 *Knowledge dissemination*

180 The participants were asked to give information on where they obtained the knowledge from
181 regarding appropriate production, preservation and utilization of ALV.

182 *Trainings on vegetables*

183 The group participants were asked whether they had ever participated in any
184 trainings/demonstrations or teachings on ALV production, preservation and utilization. They
185 were asked to indicate who had organized the trainings and, what was taught and the mode of
186 teaching.

187

188 *Challenges faced due to lack of information*

189 Another question was on their current knowledge and challenges on appropriate ALV
190 cultivation, preservation and utilization.

191 **Production, Preservation and Utilization**

192 *Production*

193 The participants were requested to list all the vegetables which they cultivated on their farms
194 or collected in the wild and the different varieties.

195

196 *Post-harvest handling and preservation*

197 In this section, the participants were requested to provide information on post-harvest handling
198 of the vegetables they produced, before taking them to the market, and also for home
199 consumption. They were also to provide information on how they typically processed and
200 preserved the vegetables.

201

202 *Utilization*

203 The participants were asked to name the different plant parts utilized and indicate whether the
204 vegetables were for home consumption or for selling. Another question was on information of
205 the members' family who consumed which vegetables and the reasons behind that. More
206 information was required on members of the family who did NOT consume (avoided) certain
207 vegetables and the reasons for that.

208

209 DATA ANALYSIS

210 Manual coding procedure was used to analyze the focus group transcripts. This consisted of
211 generating a list of key ideas, words and phrases; using ideas to formulate categories and
212 placing ideas and quotes in appropriate categories; examining the contents of each category for
213 subtopics; and selecting the most frequent for the various categories [29; 30]. The quality of
214 the coding scheme was checked using the author and the research assistant. The two analyzed
215 and coded the transcripts separately. They later met to compare the initial analysis and to reread
216 relevant portions of the transcripts when there were any discrepancies. Identification of themes
217 and categories was reached through consensus [31]. The data was presented using tables,
218 figures and through discussions and narratives.

219

220 RESULTS AND DISCUSSION

221 The results given in this paper were for ALV. Any data collected for exotic breeds of
222 vegetables or non-leafy vegetables is not reported.

223 The number of participants per group varied from 11 to 19 (14 being the median). The average
224 time taken for each FGD was 2 hrs and 33 min in Kakamega, while in Vihiga, it was 2 hrs and
225 18 min, and other topics not related to the research questions of this paper were covered in the
226 discussion. Of the participants in Kakamega, 47% were farmers, six percent were traders, and
227 47% were farmers and also traders. In Vihiga, 35% were farmers, two percent were traders,
228 and 63% were farmers and also traders. The data above shows that only a small percentage of
229 locals are full- time traders. There was a higher percentage of those who are full-time farmers.
230 However, the highest percentage was for those who are farmers and also traders. This agrees
231 with the findings of other researchers, which showed that most locals in Western Kenya are
232 subsistence farmers who use agricultural products mainly for home consumption and income
233 generation [32; 33].

234

235 **Farmers' knowledge**

236 *Knowledge Dissemination*

237 The participants gave their sources of knowledge regarding appropriate ALV production,
238 preservation and utilization attitudes and practices as shown in Table 1.

239

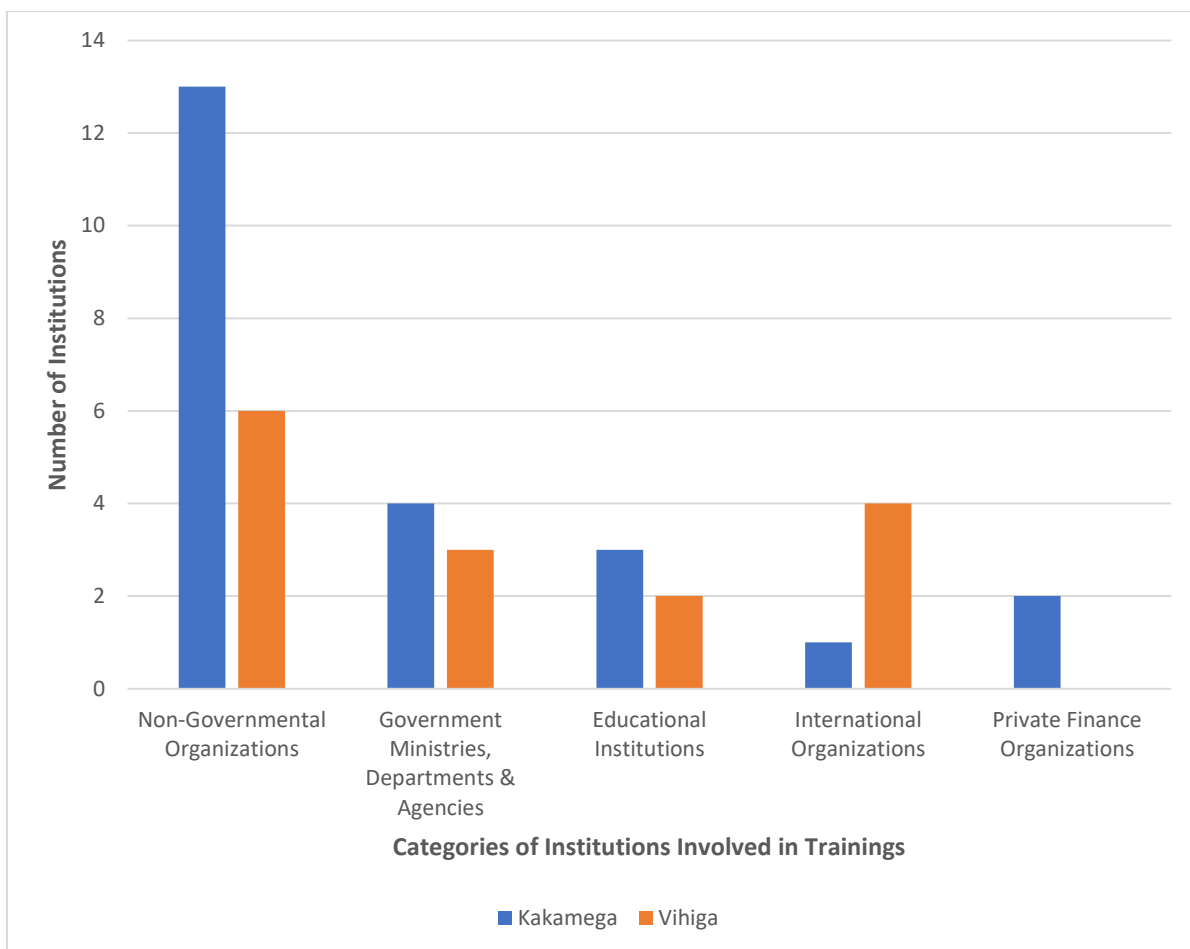
240 From the information given in the above section, it shows that there are diverse sources of
241 knowledge. All groups mentioned having received knowledge from neighbours/friends
242 /relatives/ family category and from visiting institutions. However, other sources were not
243 mentioned by all the groups. This information agrees with other researchers who reported that,
244 locals make use of traditional knowledge together with new and diverse technologies regarding
245 their attitudes and practices in vegetable production, preservation and utilization [6; 32].

246

247 *Trainings regarding ALV*

248 Many organizations were involved in offering trainings/demonstrations in various topics using
249 different media to the local farmers and traders. The organizations were in various categories
250 as given in Figure 2. The non-governmental organizations category had the highest number

251 offering trainings in both counties, while private finance organizations, specifically banks had
252 the lowest number. These results concur with findings from other researchers who reported
253 that, non-governmental organizations which are dedicated to a particular course, act as
254 strategic-bridge- builders and are able to negotiate between multiple social worlds (For
255 example, foreign donors, farmers, agricultural researchers, and the Kenyan state) and
256 knowledge domains (For example, formal agricultural science and local knowledge), and
257 ensure they succeed [34]. The topics that had been taught by the above organizations were
258 varied and included agronomic practices, production of vegetables and marketing of
259 vegetables, as shown in Table 2. ‘How to grow indigenous vegetables’ was the most favourite
260 topic taught by the institutions, because it was mentioned by 91.7% of the groups (11 out of
261 the 12). The mode of training included seminars, barazas, field visits, technical support,
262 extension services, demonstrations and /or provision of
263 inputs/equipment/implements/literature to ensure the farmers could implement what they were
264 taught.



265

266 **Figure 2: Categories and numbers of institutions involved in trainings**

267

268 ***Areas which the participants needed more knowledge***

269 The group members outlined their current knowledge challenges in regard to appropriate
 270 vegetable production, preservation and utilization. However, most of the areas which they
 271 mentioned, probably only needed reinforcing, because from the data, there was high probability
 272 that they had already been offered previously, though not to all the groups.

273

274 **Production, Preservation and Utilization**

275 ***Production***

276 Group participants gave different ALV that are produced in Western Kenya. Twenty ALV
 277 species (cultivated and wild) were identified as shown in Table 3. Different groups identified
 278 different varieties for the same vegetable species (identified either by their morphology or taste)

279 and the plant parts utilized. In 2015, another researcher gave a list of 11 ALV as she categorised
280 food plant species (sorted by food use groups) available in Western Kenya [27]. The smaller
281 number, in comparison with the findings in this study, could be attributed to the fact that, she
282 did not include those from plants whose main use may not be as a leafy vegetable. For example,
283 sweetpotato leaves and bean leaves.

284

285 ***Post-Harvest Handling and Preservation***

286 Table 4 shows how ALV for the market are handled after harvesting. The vegetables are
287 harvested either early in the morning, in the evening or at night when there is no sun. Some
288 farmers wash the vegetables, or the roots for those which are uprooted. The vegetables are put
289 under a shade, bundled and packed in sacks ready for the market. Vegetables which remain
290 unsold, are: thrown away, left at the market, given to neighbours for free, fed to domestic
291 animals, used as manure, preserved (by spreading them outside overnight and sprinkling with
292 water) to be taken to the market the following day or sun-dried for later use. These findings
293 concur with reports regarding vegetable losses in four Counties in Kenya [35]. The researchers
294 reported that the unsold vegetables are used for livestock feed, home consumption, disposed or
295 used as compost manure, though in this study there were more options given on how they deal
296 with unsold vegetables. Similar findings were reported regarding indigenous vegetable traders
297 in Kakamega, Nakuru and Kisii. It was reported that, they use unsold vegetables for family
298 consumption, sell it the following day, feed livestock; or discard it [36].

299 The group participants also outlined how vegetables for home consumption, are handled after
300 harvesting and prepared, as shown in Table 5. Most of the vegetables for home consumption
301 are washed, cut into small pieces: fried; boiled and then fried; boiled/fried and then added sour
302 or fresh milk; boiled in *msherekha*, fried and added milk; boiled in *msherekha* and added milk;
303 then the vegetables are served either hot or cold. Most of the indigenous vegetables are mixed

304 with others and duration of cooking varies from vegetable to vegetable. These methods of
305 preparation agree well with methods reported in a survey undertaken in South-Western
306 Uganda, which indicated that although the methods of food preparation for home consumption,
307 varied from one household to another, boiling, steaming and frying were very common and
308 cross-cutting in almost all the households [37]. Musotsi and his friends reported that most of
309 the indigenous vegetables in western Kenya are boiled in unspecified amounts of water, or
310 some form of wet heating. There was addition of bicarbonate of soda; and once the vegetables
311 are simmered, there would be some additives such as milk, cream, ghee, groundnut sauce or
312 simsim sauce. It seems with time, the local communities are moving more towards frying the
313 vegetables [38]. Similarly, findings were reported regarding preparation methods for traditional
314 vegetables in Tanzania. They prepared the vegetables mostly by steaming, boiling or stir-frying
315 in combination with other vegetables such as onions and tomatoes [39].

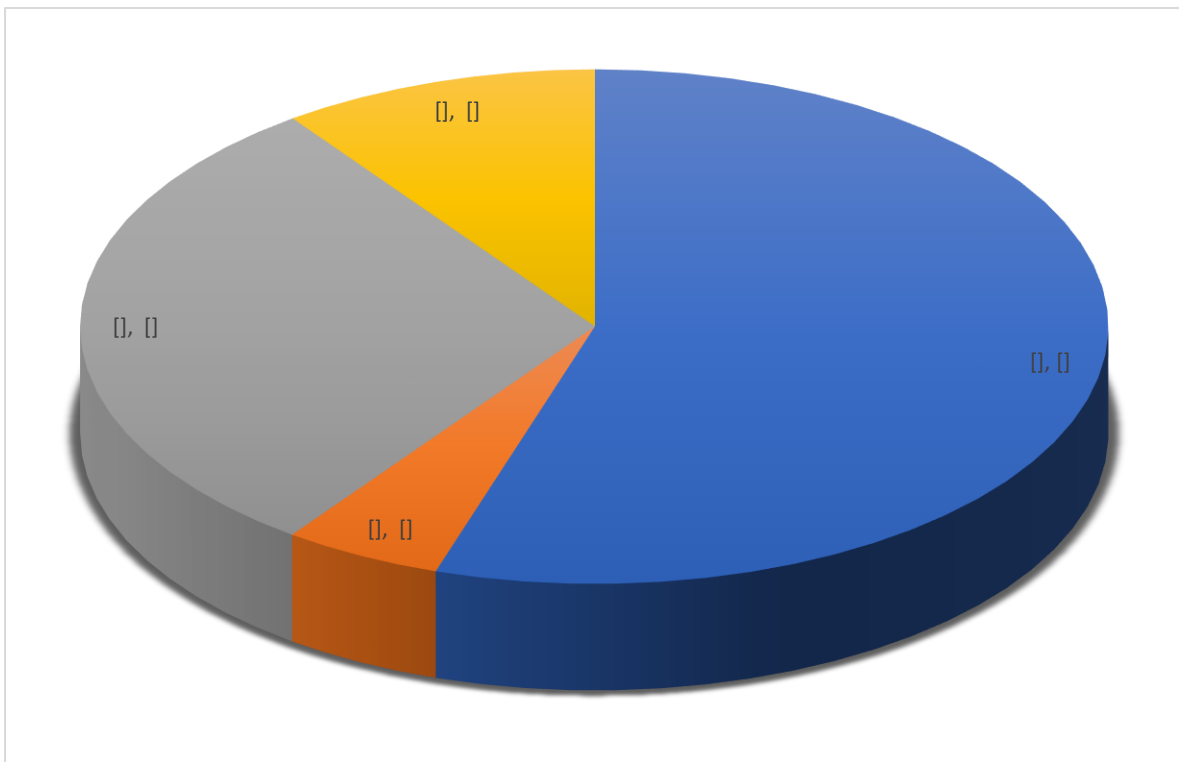
316

317 Though preservation for long periods was rare, a few participants outlined how they preserved
318 some vegetables for long periods, as given in Table 6. There were only two methods used to
319 preserve the vegetables. By boiling everyday or by drying in the sun. It was noted that most of
320 the farmers were not preserving the vegetables for long periods. Reasons given were; they
321 lacked preservation skills, the taste changes and they do not have periods in they year when
322 they totally lack the fresh vegetables. Similar sentiments were reported regarding farmers in
323 Kakamega, Kisii and Nakuru who were not satisfied with the current methods of indigenous
324 vegetables preservation. This was attributed to the perception by farmers that available methods
325 of postharvest treatment, such as sun drying, solar drying and blanching are ineffective,
326 expensive, unsustainable, or farmers were not aware of how to appropriately use them [36].

327

328 *Utilization*

329 The participants were able to indicate how they use vegetables, whether for home consumption
330 or for sale. This is shown in Figure 3. Some vegetables are sold and consumed in equal
331 measure. These are the ALV which have been domesticated for a long time and are well known
332 in the area. Only Moringa and African nightshade are sold more than consumed by the farmers,
333 probably Moringa has become very commercial because of its health benefits while African
334 nightshade has found commercial success in Kenya [40]. Only pumpkin leaves, among the
335 cultivated species are consumed more by the farmers than sold. Most of the wild vegetables
336 are not sold. Similarly, most of the ALV from plants which have multiple uses are not sold.
337 One could only get them from their farms or by being given by a friend. There were no
338 vegetables



339

340 **Figure 3: Utilization of ALV by either selling or home consumption**

341

342 where the farmers sold everything. These results agree with findings from other researchers in
343 the area. A market survey on ALV, found that in three markets in Western Kenya, vegetables

344 included cowpea leaves, pigweed, African nightshades, jute mallow, spiderplant, slenderleaf,
345 African kale, and pumpkin leaves [41]. Indeche found that over 50 percent of the women
346 farmers grew African nightshade, cowpea leaves, slenderleaf, jute mallow and spider plant
347 [42]. These were also the most common ALV in the markets. Another researcher reported that
348 Amaranthus species, Solanum species and cowpea leaves were available in six markets [33].
349 Most of the ALV are consumed by all the family members and most people in the community.
350 However, several ALV are consumed by specific individuals and during particular times. There
351 are varied reasons why some vegetables are encouraged or discouraged for specific individuals
352 or group of individuals.

353

354 *African Leafy Vegetables which are Encouraged for Specific Groups and the Reasons*

355

356 Table 7 gives thirteen ALV which are encouraged for specific individuals and the reasons. It is
357 evident from the table that apart from providing essential nutrients, these vegetables are
358 believed to offer more health benefits. These benefits include: improving immunity, easing
359 delivery, promoting blood production and stimulating milk production for lactating mothers.
360 Similar findings have been reported by other researchers. Walingo reported that the perceived
361 role of indigenous vegetables in health include: increasing blood, increasing milk production
362 in lactating women, making body strong, preventing prostate cancer, treating hypertension and
363 fever, providing energy and relieving constipation and stomach-ache [43]. Another group of
364 researchers reported that, indigenous vegetables are believed to: treat diabetes, high blood
365 pressure, backache, colds and coughs, stomach ache, cancer, asthma, TB, anemia, fainting,
366 backache, malaria, chest pains, digestive problems, AIDs, diarrhea, skin rashes, typhoid,
367 oedema; cleanses blood, improves eye sight, boosts appetite, and revitalizes the body [5].
368 Although different regions report variations in the kind of benefits offered and also differences
369 in the particular vegetables providing these benefits, it is evident that these extra benefits
370 greatly motivate those who consume the vegetables to continue utilizing them. Most of the

371 benefits seem to be towards improving immunity, promoting blood production and stimulating
372 milk production for lactating mothers. It would be important for future studies to verify these
373 traditional beneficial claims.

374 *African Leafy Vegetables which are Discouraged for Specific Groups (Avoided) and the*
375 *Reasons*
376

377 The ALV which are avoided/discouraged for specific members and the reasons are given in
378 Table 8. Twelve ALV are not consumed by specific persons, either because of social believes,
379 some of which have some truth in them but others are completely baseless. Or because of their
380 bitter taste or the youth do not know how to prepare them. These results agree with the findings
381 of a study conducted in Uganda by Hart and Mouton [44]. They reported that some of the
382 indigenous vegetables have taboos associated with them, which are assumed to affect certain
383 categories of people who come into contact with them. They are used as a means of local social
384 control and explanations of misfortune. They also noted that due to taste preferences and
385 experience, elderly residents had almost exclusive knowledge about a few specific traditional
386 vegetables which were no longer consumed or generally used by the younger residents. This
387 knowledge included food preparation and ritual practices.

388 CONCLUSION

389 It is evident from the findings of this study that, the highest percentage of those who
390 participated in the focus groups, were farmers and also traders. There are diverse sources of
391 knowledge, both from the local community, visiting institutions and individual initiatives.
392 Among the visiting organizations, non-governmental organizations category had the highest
393 number offering trainings in both counties. While '*How to grow indigenous vegetables*' was
394 the most favourite topic taught by the visiting organizations. Despite the many trainings, a
395 number of topics still needed reinforcing, as the farmers felt ill-equipped.

396

397 Nineteen different ALV consumed in western Kenya were identified. These included both
398 domesticated and wild vegetables. Vegetables for the market are harvested either early in the
399 morning, in the evening or at night when there is no sun. Vegetables which are not sold, are:
400 thrown away, left at the market, given to neighbours for free, fed to domestic animals, used as
401 manure, or preserved for later use. Most of the ALV for home consumption, are mixed with
402 others and duration of cooking varies from vegetable to vegetable. They are washed, cut into
403 small pieces: fried; boiled and then fried; boiled/fried and then added sour or fresh milk; boiled
404 in *msherekha*, fried and added milk or boiled in *msherekha* and added milk; then served either
405 hot or cold. Finally, most of the farmers were not preserving the vegetables for long periods
406 because, they lack preservation skills, the taste changes and they do not have periods in they
407 year when they totally lack the fresh vegetables.

408

409 The ALV which have been domesticated for a long time and are well known in the area are
410 sold and home consumed in equal measure. These include; cowpea leaves, jute mallow, slender
411 leaf, spider plant, pigweed and African kale. Only Moringa and African nightshade are sold
412 more than consumed by the farmers. Only pumpkin leaves are consumed more by the farmers
413 than sold. Most of the wild ALV and those from plants which have other parts which are
414 utilized are not sold. There were no vegetables where the farmers sold everything. Apart from
415 providing essential nutrients, several vegetables are believed to offer more health benefits,
416 especially towards improving immunity, promoting blood production and stimulating milk
417 production for lactating mothers. A number of ALV are not consumed by specific persons,
418 either because of social beliefs, their taste or lack of knowledge on how to prepare them by the
419 younger generation.

420

421 ACKNOWLEDGEMENTS

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Sources of knowledge	% of groups
1. Institutions. Such as Training institutions, Ministries, NGOs	100
2. Neighbours /friends / relatives/ family	100
3. Radios, television, internet, social media.	50
4. Agricultural fairs.	50
5. Magazines, newspapers, books, literature.	33
6. Groups: Farmer - men- or women- groups	33
7. Village administration. Such as Barazas, meetings.	33
8. Social functions. Such as church functions, funerals	33
9. Personal creativity.	8

423 Kakamega and Vihiga County administration and the Farmer groups which participated in the

424 Focus Groups.

425 **Table 1: Sources of knowledge for the farmers and Percent of groups that mentioned a**
426 **particular source**

427
428

Table 2: Topics taught to the Groups and Percent of groups that had received a particular training

Broad area	Specific teachings	% of groups
Agronomic practices	• Pest control (How to make pesticides from local herbs for vegetables)	8.3
	• Weather training, timing of land preparation, planting, harvesting, sensitization on rainy seasons.	50
	• Soil conservation and rehabilitation, making water channels, double digging	25
	• Composting, preparation of organic manure, how to use fertilizer, animal manure for maximum benefits.	58
	• Mixed farming	8.3
	• Mandela gardens, French gardens, Portable gardens, vertical gardens, sack vegetable beds	25
	• Rainwater harvesting and use of run-off, irrigation	25
Production of vegetables	• How to grow indigenous vegetables (i.e. <i>kunde, miroo, litsutsa, seveve, mrenda</i>)	91.7
	• Seed harvesting, seed bed preparation	33.3
	• Utilization of vegetables	33.3
	• Preservation using solar drier, value addition	41.7
Financial management	• Growing vegetables using a little amount of water	16.7
	• Record keeping, workplan	16.7
	• How to get capital to start a business (Table banking, Management of loans)	33.3
	• Writing business plan and proposal	8.3
	• Opening a business, expanding the business (Vegetable production as an income generating activity, Marketing of vegetables)	50

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430 **Table 3: Diversity of African leafy vegetables cultivated and consumed in Western Kenya**

Vegetable species		Sub-species/ cultivar		Plant parts used
English name	Local names	Scientific name		
1. Cowpea leaves	<ul style="list-style-type: none"> • <i>Likhubi</i> • <i>Kunde</i> 	<i>Vigna unguiculata</i>	<ul style="list-style-type: none"> • <i>Lihanda-Drought resistant</i> (Climbing variety) • <i>Enzeku</i> (Bush /standing variety) • <i>Likhubaika</i> • Wide-leafed • Narrow leafed 	<ul style="list-style-type: none"> • Leaves • Seeds
2. African nightshade	<ul style="list-style-type: none"> • <i>Lisutsa</i> • <i>Managu</i> 	<ul style="list-style-type: none"> • <i>Solanum villosum, Solanum americanum, Solanum scabrum</i> 	<ul style="list-style-type: none"> • The bitter variety • Non-bitter variety 	<ul style="list-style-type: none"> • Leaves
3. Slender leaf	<ul style="list-style-type: none"> • <i>Miroo</i> • <i>Mito</i> • <i>Emiro</i> • <i>Marejea</i> 	<ul style="list-style-type: none"> • <i>Crotalaria ochroleuca</i> 	<ul style="list-style-type: none"> • Bitter variety • The non-bitter variety (<i>Mibobo</i>) 	<ul style="list-style-type: none"> • Leaves
4. Jute mallow, Jew's mallow, bush okra, Egyptian spinach.	<ul style="list-style-type: none"> • <i>Mrenda</i> • <i>Murere</i> • <i>Omurere</i> 	<ul style="list-style-type: none"> • <i>Corchorus olitorius, Corchorus acutangulus, Corchorus olitorius, Corchorus trilocularis, Corchorus tridens</i> 	<ul style="list-style-type: none"> • Bitter variety • Indian variety • Big leafed • Small leafed • Tall stems 	<ul style="list-style-type: none"> • Leaves • Young seeds
5. Pumpkin leaves	<ul style="list-style-type: none"> • <i>Seveve</i> • <i>Malenge</i> • <i>Lisebebe</i> 	<ul style="list-style-type: none"> • <i>Cucurbita moschata, Cucurbita maxima</i> 	<ul style="list-style-type: none"> • The one with round-edged leaves • Rough/saw-edged leaves 	<ul style="list-style-type: none"> • Leaves • Fruits • Seeds
6. Spider plant	<ul style="list-style-type: none"> • <i>Saga</i> • <i>Tsisaka</i> • <i>Mgagani</i> 	<ul style="list-style-type: none"> • <i>Cleome gynandra, Cleome hirta</i> 	<ul style="list-style-type: none"> • Bitter • Non-bitter 	<ul style="list-style-type: none"> • Leaves
7. Pigweed, Leaf amaranth	<ul style="list-style-type: none"> • <i>Dodo</i> • <i>Mchicha</i> • <i>Zimboga</i> • <i>Tsimboka</i> • <i>Libokoyi</i> • <i>Chiboga</i> • <i>Livokoi</i> 	<ul style="list-style-type: none"> • <i>Amaranthus blitum, Amaranthus cruentus, Amaranthus retroflexus</i> 	<ul style="list-style-type: none"> • Small leaves • Big leaves • With thorns • Without thorns 	<ul style="list-style-type: none"> • Leaves • Seeds • Young stems
8. African kale, Ethiopian cabbage, Ethiopian kale	<ul style="list-style-type: none"> • <i>Kanzira</i> • <i>Ikanzira</i> 	<i>Brassica carinata</i>	<ul style="list-style-type: none"> • One cultivar 	<ul style="list-style-type: none"> • Leaves
9. Vine spinach, African spinach, Indian spinach	<ul style="list-style-type: none"> • <i>Nderema</i> • <i>Inderema</i> 	<i>Basella alba</i>	<ul style="list-style-type: none"> • Broad leaves • Small leaves 	<ul style="list-style-type: none"> • Leaves
10. Bean leaves	<ul style="list-style-type: none"> • <i>Makhalaba</i> 	<i>Phaseolus vulgaris</i>	<ul style="list-style-type: none"> • 10 varieties - 	<ul style="list-style-type: none"> • Leaves, • Seeds

				maturity growth type, shape of seeds	time type,	
11.	-	<ul style="list-style-type: none"> • <i>Lirunde</i> • <i>Murunde</i> 		• One cultivar		• Leaves
12.	-	• <i>Imbetsa</i>		• One cultivar		• Leaves
13.	Cassava leaves	• <i>Mwuogo</i>	<i>Manihot esculenta</i>	• Reddish		• Leaves
14.	Sweet potato leaves	<ul style="list-style-type: none"> • <i>Milavi</i> • <i>Mabwoni</i> 	<i>Ipomoea batatas</i>	• Green		• Tubers
				• With purple leaves		• Leaves
				• With green leaves		• Tubers
				• With white leaves		
				• With yellow-fleshed tubers		
15.	Blackjack	• <i>Ingyesi</i>	<i>Bidens pilosa</i>	• One cultivar		• Leaves
16.	Pepper leaves	• <i>Ipilipili</i>	<i>Capsicum annum</i>	• One cultivar		• Fruit
17.	Moringa		<i>Moringa oleifera</i>	• One cultivar		• Leaves
						• Seeds
						• Pods
18.	Wandering Jew, Dayflower	<ul style="list-style-type: none"> • <i>Linyolonyolo</i> • <i>Linyoronyoro</i> • <i>Lifwafwa</i> 	<i>Commelina benghalensis</i>	• One cultivar		• Leaves
						• Vines
19.	-	<ul style="list-style-type: none"> • <i>Kitiezo</i> • <i>Shirietso</i> 	<i>Erythrococca bongensis</i>	• One cultivar		• Leaves

Table 4: Post-harvest Handling of Vegetables for the Market

<i>Vegetable species</i>	<i>Post-harvest handling when brought to the market</i>
1. Cowpea leaves, slender leaf	<ul style="list-style-type: none"> – It is harvested when there is no dew. – It is spread outside overnight. It is packed in sacks, ready for the market in the morning. – The roots are cut off before packing – Alternatively, it is harvested when there is no dew, spread under a shade while bundling (tying in bundles), packed in sacks, kept in the house (Farmer’s house) awaiting transportation. – If they remain from the market, they spread the vegetables outside during the night so that they stay fresh – They give to neighbors for free. – If not sold for long, they throw away.
2. Thinnings for: Cowpea leaves, pigweed, slender leaf, Jute mallow, African kale	<ul style="list-style-type: none"> – Uproot the vegetables. Shake the soil, wash the roots, drain, sprinkle water on the leaves, tie into bundles, put in a basket, take to the market. – If all are not sold, sprinkle water on them and leave them out in the night, bring in during the day.
3. African nightshade, Jute mallow, cowpea leaves, pigweed, and spider plant	<ul style="list-style-type: none"> – Should be picked in the early morning hours before the sun rises and placed under the shade. – Bundle and put into a sack and cover with banana leaves – If vegetables remain, put under the shade in the cold. – The vegetables can stay for two days. – If vegetables remain, throw away, leave it at the market, or use it as manure. – The remains from the market should be taken back the following day or sold to neighbors at a lower price near home. – Otherwise, give the animals or make manure. Do not give away.

Table 5: Post-harvest Handling and Preparation of Vegetables for Direct Consumption

<i>Vegetable species</i>	<i>Processing for direct consumption</i>
1. Slender leaf	<ul style="list-style-type: none"> – Remove the twigs. Wash in plenty of water. Put in sufuria, add <i>msherekha</i> (ash decant: prepared from burnt dried bean stalks or banana fibres) and boil for about 15 min. Remove the remaining soup. Add milk and a little salt. Boil for about 10 min. Serve while hot with ugali. – Alternatively: Remove the twigs. Wash in plenty of water. Put in sufuria, add <i>msherekha</i>, and boil for about 15 min. Drain. Fry in oil, onion, and tomato for 2 mins.
2. African nightshade, African Kale, pigweed and spider plant	<ul style="list-style-type: none"> – Mix them. Boil for 30-40 mins. Drain the water. Fry in oil, onion, and tomato, add milk/cream, and cook for 7 mins.
3. African nightshade + spider plant + pigweed	<ul style="list-style-type: none"> – After plucking, wash in plenty of water. Put in a pot, add a little salt, and enough water. Boil for about 30 min. Add sour milk, serve hot with ugali. – Alternatively: After washing, use a pot for cooking. Put the vegetables inside the pot, sprinkle with a little salt, boil in a closed pot for about 30 min. Remove from the heat. Let them stay for 12 hrs. Put oil, onions, and spices in the vegetables, add sour milk. Boil for 5 min. Serve while hot with ugali. This meal can stay for three days.
4. Cowpea leaves	<ul style="list-style-type: none"> – Wash in plenty of water. Put in a pot and sprinkle salt. Cook for about 2 hrs in a covered pot. Serve while hot with cold ugali. – Alternatively: Boil in water with <i>musherekha</i> for 5 mins. Put oil, onion, and tomato on top and mix.
5. <i>Okulunga</i> – Cowpea leaves, pumpkin leaves, slender leaf, Jute mallow, vine spinach, mushroom	<ul style="list-style-type: none"> – Pick vegetables. Remove the twigs and wash. Boil water and add <i>musherekha</i> and salt. Add the vegetables. Cook for 10-20 min. Remove and drain. Fry. Add milk and serve
6. <i>Tsiamatsi</i> - African nightshade, spiderplant, amaranth, African kale, cowpea leaves	<ul style="list-style-type: none"> – Pick vegetables. Remove the twigs and wash. Fry onion and tomatoes. Add vegetables. Cook for 30 min – covering with banana leaves. Stir/turn. Boil for another 20 min. Add milk and serve.
7. Jute mallow	<ul style="list-style-type: none"> – Boil for 30-40 mins. Drain the water. Fry in oil, onion, and tomato, add milk/cream, and cook for 7 min.
8. African Kale	<ul style="list-style-type: none"> – Wash and cut into small pieces. Fry in oil, onion, and tomatoes for 10 mins.
9. Vine spinach	<ul style="list-style-type: none"> – Mixed with other vegetables. Fry in oil, onion, and tomatoes for 5 mins.

437 **Table 6: Post-harvest Handling and Preservation for Long Periods**

	<i>Vegetable Species</i>	<i>Procedure for preservation</i>
1.	Cowpea leaves, Slender leaf	– Dry. However, not common.
2.	African nightshade, Jute mallow, cowpea leaves, pigweed, and spider plant	– Cook by boiling. Then boil every day to preserve. – Alternatively: Put outside to let any insects crawl away. Dry in the sun for two days. Store in an open container somewhere in the kitchen. – Alternatively: Put in a paper bag and aerate (put holes).
3.	Slender leaf	– Boil vegetables and keep boiling and draining water every day. Do not add tomatoes, because it spoils it.
4.	African nightshade, African kale, amaranth and spider plant	– Dry in the sun and store in an open container.
5.	Jute mallow	– Boil until cooked and drain. Dry in the sun until very dry (powdery dry).
6.	Cowpea leaves	– Wash and drain. Dip vegetables in hot water with <i>msherekha</i> and dry in the sun.

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Table 7: African leafy vegetables which some members of the family are encouraged to consume and the reasons

<i>Vegetable species</i>	<i>Family members</i>	<i>Reason</i>
1. Pumpkin leaves	Those with weak immunity	Promotes blood formation
2. Jute mallow	Pregnant women	For ease of delivery
	Lactating mothers	Associated with increased milk production
	Women and children	<ul style="list-style-type: none"> • It is cheap • It strengthens joints and bones
	Men (In some clans)	Known to add sexual energy and general body energy
	Members who have chest blockage issues	Purifies the chest/good for asthma patients
3. <i>Shirietso</i> , bean leaves, arrowroots leaves, cassava leaves	Old family members	They know how to prepare them
4. Vine spinach	Lactating mothers	<ul style="list-style-type: none"> • Boosts blood production • Stimulates milk production
	Pregnant women	To help the placenta come out quickly
	Lactating mothers	Associated with increased milk production
5. Spider plant	Pregnant women	To give them minerals
	Stressed family members	To reduce stress
	Lactating women	<ul style="list-style-type: none"> • Stimulates milk production • Boosts blood production
6. African nightshade	Sick people	Used as medicine
7. Chilli leaves	Drinking men	Handles hangovers
8. Pumpkin leaves	Lactating women	<ul style="list-style-type: none"> • Stimulates milk production • Boosts blood production
	Those with low immunity	Boosts immunity status
9. African kale, pigweed	Lactating women	<ul style="list-style-type: none"> • Stimulates milk production • Boosts blood production
10. Moringa	Those with low immunity	Boosts immunity status

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Table 8: African leafy vegetables which some members of the Family do NOT Consume (Avoid) and the Reasons

<i>Vegetable species</i>	<i>Family members</i>	<i>Reason</i>
1. Vine spinach	Some clans	<ul style="list-style-type: none"> • They swore and believed they could not eat. • They itch if they eat. • It is food for snakes
	All	People do not know it

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2.	Bean leaves	Some clans Men (especially those who drink)	They swore never to eat. It is cooked by boiling
3.	Spider plant	Children Those with ulcers	They are bitter. They are acidic
4.	African nightshade	Children	They are bitter.
5.	Slender leaf	Some families Those with ulcers	They believe if eaten in plenty can cause kidney problems. They are acidic
6.	<i>Shirietso</i>	Some clans Lactating mothers The young generation Some families	Believe if one eats, they go mad. Dries breastmilk They do not know how to prepare Associated with the low class in society.
7.	<i>Murunde</i>	Men Some families	<ul style="list-style-type: none"> • They do not like it. • They dislike the slipperiness of the vegetable Associated with the low class in society.
8.	Cowpea leaves	Lactating mothers Women who have delivered	Dries breastmilk. <ul style="list-style-type: none"> • Too much fiber • It is cooked with ‘<i>msherekha</i>.’
9.	<i>Imbetsa</i> , Wandering Jew	Some families	Associated with the low class in society.
10.	Bitter slender leaf, bitter African nightshade	The youth	They do not like the taste.
11.	Jute mallow	Some clans, e.g., <i>Basoi</i> (Local herbalists) Men Those with ulcers Some individuals	They believe if eaten a curse will not get to its target/herbs will not heal <ul style="list-style-type: none"> • They do not like it. • They dislike the slipperiness of the vegetable • Leads to impotence and reduce their ability to engage in sex • Most people do not know how to cook Jute mallow well. They are acidic Makes people oversleep
12.	Sweet potato leaves	Some members	They lack information on how to prepare them.

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447 REFERENCES

- 448 1. **Smith IF and P Eyzaguirre** African Leafy Vegetables: their role in the World Health
449 Organization's Global Fruit and Vegetables. *Afr J Food Agr Nutr*; 2007; **7** (3).
450
- 451 2. **Mnzava NA** Comparing nutritional values of exotic and indigenous vegetables. In
452 African Indigenous Vegetables (Rudy Schippers and Leonard Budd ed). Proceedings
453 of /IPGRI/ International Workshop on African Indigenous Vegetables. 1997: 70-75.
454
- 455 3. **Muchoki CN** Nutritional, sensory and keeping properties of fermented solar-dried
456 cowpea leaf vegetables. Msc. Thesis. University of Nairobi. 2007
457
- 458 4. **Chweya JA and PB Eyzaguirre** The biodiversity of traditional leafy vegetables.
459 IPGRI publication, Rome, Italy.1999
460
- 461 5. **Kimiywe J, Waudo J, Mbithe D and P Maundu** Utilization and Medicinal Value of
462 Indigenous Leafy Vegetables Consumed in Urban and Peri-Urban Nairobi. *AJFAND*.
463 2007; **7** (4).
464
- 465 6. **Oniangó RK, Mutuku JM, and SJ Malaba** Contemporary African Food Habits and
466 their nutritional and health implications. *Asia Pacific J. Clin Nutr*. 2003; **12** (3): 231 –
467 236.
468
- 469 7. **Walingo MK and BN Ekesa** Nutrient Intake, Morbidity, and Nutritional Status of
470 Preschool Children are Influenced by Agricultural and Dietary Diversity in Western
471 Kenya. *Pakistan Journal of Nutrition*. 2013; **12** (9): 854 -859.
472
- 473 8. **Noack AL and NRM Pouw** A blind spot in food and nutrition security: where culture
474 and social change shape the local food plate. *Agriculture and Human Values*. 2015;
475 **32**:169–182.
476
- 477 9. **Kenya District Boundary Map**. USGS, EROS Data Center, citing Kenya Bureau of
478 Statistics, Cartographic Section, 1989: Kenya population census District maps, 1989
479 (<http://igskmncnwb015.cr.usgs.gov/ftp2/vector/admn/keadm3.gif>).
480
- 481 10. **Kenya National Bureau of Statistics** 2019 Kenya Population and Housing Census,
482 2019 Vol 1 and 4. <http://www.knbs.or.ke>
483
- 484 11. **Kenya National Bureau of Statistics**. Kakamega County Statistical Abstract. 2017.
485 <http://www.knbs.or.ke>
486
- 487 12. **Kanyenji GM, Ng'ang'a SK and EH Girvetz** Survey data on factors that influence
488 the adoption of soil carbon enhancing practices in Western Kenya. *Sci Data*. 2020;
489 **7**: 37. <https://doi.org/10.1038/s41597-020-0374-1>

490

491 13. **Marenya PP, Oluoch-Kosura W, Place F and CB Barrett** Education, nonfarm
492 income, and farm investment in land-scarce western Kenya. 2003; 14
493 Repository.uonbi.ac.ke
494

495 14. **Valbuena D, Groot JCJ, Mukalama, J. et al.** Improving rural livelihoods as a
496 “moving target”: trajectories of change in smallholder farming systems of Western
497 Kenya. *Reg Environ Change* 2015; 15: 1395–1407. [https://doi.org/10.1007/s10113-](https://doi.org/10.1007/s10113-014-0702-0)
498 014-0702-0 Springer).

499

500 15. **Vihiga County.** County Intergrated Development Plan (2013–2017), County
501 Government of Vihiga.
502

503 16. **Kakamega County.** The second County Integrated Development Plan (CIDP) FY
504 2018 – 2022, County Government of Kakamega.
505

506 17. **Krueger RA and MA Casey.** Focus groups: a practical guide for applied research. 4th
507 edition. Thousand Oaks, California: Sage; 2009. **In:** Carlsen B and C Glenton. What
508 about N? A methodological study of sample-size reporting in focus group studies *BMC*
509 *Medical Research Methodology* 2011; 11: 26. [http://www.biomedcentral.com/1471-](http://www.biomedcentral.com/1471-2288/11/26)
510 2288/11/26].

511

512 18. **Powell RA and HM Single.** Focus groups. *Int J Qual Health Care* 1996; **8**:499-504.
513

514 19. **Morgan DL.** Focus Groups as Qualitative Research. 2nd edition. Thousand Oaks: Sage
515 Publications; 1997. **In:** Carlsen B and C Glenton What about N? A methodological
516 study of sample-size reporting in focus group studies *BMC Medical Research*
517 *Methodology* 2011; 11: 26. <http://www.biomedcentral.com/1471-2288/11/26>].
518

519 20. **Kitzinger J** Qualitative Research: Introducing focus groups. *BMJ* 1995; 311:299-302.
520

521 21. **Bender DE and D Ewbank** The focus group as a tool for health research: Issues in
522 design and analysis. *Health Transition Review* 1994; **4**:63-79.
523

524 22. **Nyumba TO, Wilson K, Derrick CJ, Mukherjee N.** The use of focus group
525 discussion methodology: Insights from two decades of application in conservation.
526 *Methods in Ecology and Evolution* . British Ecological Society. 2017.
527

528 23. **Carlsen B and C Glenton** What about N? A methodological study of
529 sample-size reporting in focus group studies *BMC Medical Research Methodology*
530 2011; **11**: 26. <http://www.biomedcentral.com/1471-2288/11/26>].
531

- 532 24. **Pearson D and A Vossler.** Methodological issues in focus group research: The
533 example of investigating counsellors' experiences of working with same-sex couples.
534 *Counselling Psychology Review*, 2016; **31**: 1.
535
- 536 25. **Basch CE.** Focus group interview: An underutilized research technique for improving
537 theory and practice in health education. *Health Education Quarterly*, 1987; **14**(4): 411–
538 448.
539
- 540 26. **Wiggins G.S.** The analysis of focus groups in published research articles. *The*
541 *Canadian Journal of Program Evaluation* **19** (2): 143–164.
542
- 543 27. **Kanui MN** Variety for security: A case study of agricultural, nutritional and dietary
544 diversity among smallholder farmers in Western Kenya. PhD. Thesis. University of
545 Oxford, England. 2015.
546
- 547 28. **Onwuegbuzie AJ, Dickinson WB, Leech NL and AG Zoran** A Qualitative
548 Framework for Collecting and Analyzing Data in Focus Group Research. *International*
549 *Journal of Qualitative methods*. 2009.
550
- 551 29. **Burke, V., Giangiulio, N., Gillam, H.F., Beilin, L.J., Houghton, S., & Milligan,**
552 **R.A.K. (1999).** Health promotion in couples adapting to a shared lifestyle. *Health*
553 *Education Research*. 1999; 14(2), 269–288.p. 274; **In:** Wiggins G.S. The analysis of
554 focus groups in published research articles. *The Canadian Journal of Program*
555 *Evaluation* **19** (2): 143–164.
556
- 557 30. **McLaughlin HJ, Liljestrom A, Lim JH and D Meyers** LEARN: A community study
558 about Latino immigrants and education. *Education and Urban Society*, 2002; **34** (2),
559 212–232.
560
- 561 31. **Saulnier CF and E Wheeler** (2000). Social action research: Influencing providers and
562 recipients of health and mental health care for lesbians. *Affilia*, 2000; **15**(3): 409–433.
563
- 564 32. **Rao J, Cadilhon JJ, Midega C, Atieno F, Oduor FO, Termote C, Auma JO, Mango**
565 **N, Okeyo I, Odhiambo GD and M Wesonga** A situational analysis of agricultural
566 production and marketing, and natural resources management systems in West Kenya.
567 *International Livestock Research Institute (ILRI)*. 2015.
- 568 33. **Abukutsa-Onyango M** The diversity of cultivated African leafy vegetables in three
569 communities in Western Kenya. In: Oniango R, Grum M, and E Obel-Lawson (eds.)
570 *Developing African Leafy Vegetables for Improved Nutrition*. Regional Workshop, 6
571 – 9 Dec. 2005. ROP publishers. Nairobi, Kenya. 2007: 85 -91
572
- 573 34. **Goldberger JR.** Non-governmental organizations, strategic bridge building, and the
574 “scientization” of organic agriculture in Kenya. *Agriculture and Human Values* (2008)
575 25:271–289 Springer 2007 DOI 10.1007/s10460-007-9098-5

576

577 35. **Ndirangu SN, Kanali C, Mutwiwa U, Kituu G, Kamwere M and J Mung'atu**
578 Determinants of postharvest losses among high moisture content vegetables traders in
579 Kenya. *Journal of Postharvest Technology*. 2017; **5**(2): 37- 46
580

581 36. **Gogo EO, Opiyo A, Ulrichs C and S Huyskens-Keil** Loss of African Indigenous
582 Leafy Vegetables along the Supply Chain, *International Journal of Vegetable Science*
583 2018; **24**(4): 361-382, DOI: 10.1080/19315260.2017.1421595.
584

585 37. **Musinguzi E, Kikafunda JK and BT Kiremire** Utilization of Indigenous Food Plants
586 in Uganda: A Case Study of South-Western Uganda. *AJFAND* 2006; 6 (2).
587

588 38. **Musotsi AA, Sigot AJ and MO Abukutsa- Onyango** African Indigenous Vegetables
589 Recipe Documentation and their Role in Food Security. **In:** Abukutsa-Onyango MO,
590 Muriithi AN, Anjichi VE, Ngamau K and Agong SG, Fricke A, Hau B and H Stützel
591 (eds). Proceedings of the Third Horticulture Workshop on Sustainable Horticultural
592 Production in the Tropics, 26 -29 November 2003. Maseno University, MSU, Maseno,
593 Kenya. 2005:105- 111.
594

595 39. **Keller GB** African nightshade, eggplant, spiderflower et al. Production and
596 consumption of traditional vegetables in Tanzania from the farmers point of view. MSc.
597 Thesis. The University of Göttingen, Germany. 2004.
598

599 40. **Khalai S** Traditional Luhya Vegetables. [www. mulembenation.co.ke](http://www.mulembenation.co.ke). 2020.
600

601 41. **Abukutsa-Onyango MO, Mwai GN and JC Onyango** Studies on Horticultural
602 Practices of Some African Indigenous Vegetables at Maseno University. **In:** Abukutsa-
603 Onyango MO, Muriithi AN, Anjichi VE, Ngamau K and Agong SG, Fricke A, Hau B
604 and H Stützel (eds). Proceedings of the Third Horticulture Workshop on Sustainable
605 Horticultural Production in the Tropics, 26 -29 November 2003. Maseno University,
606 MSU, Maseno, Kenya. 2005:13 -18.
607

608 42. **Indeche A** Assessing Readiness of Indigenous Vegetable Women Farmers in
609 Kakamega County to Satisfy Quality Standards of High Value Markets in Kenya.
610 MPhil. Thesis. University of Cape Coast. 2015.
611

612

613 43. **Walingo MK** Dietary Efficacy of African Indigenous Vegetables in The Control of
614 Micronutrient Deficiencies for Poverty Alleviation and Nutrient Security. **In:**
615 Abukutsa-Onyango MO, Muriithi AN, Anjichi VE, Ngamau K and Agong SG, Fricke
616 A, Hau B and H Stützel (eds). Proceedings of the Third Horticulture Workshop on
617 Sustainable Horticultural Production in the Tropics, 26 -29 November 2003. Maseno
618 University, MSU, Maseno, Kenya. 2005: 125 -134.
619

- 620 44. **Hart T and J Mouton** Indigenous Knowledge and its Relevance for Agriculture: A
621 Case Study in Uganda. *Indilinga African Journal of Indigenous Knowledge Systems*
622 2005; **4** (1): 249-263.