

**INDIGENOUS KNOWLEDGE ON THE USES OF
AFRICAN NIGHTSHADES (*Solanum nigrum* L.) SPECIES
AMONG THREE KENYAN COMMUNITIES**

Abstract

In Kenya, the African nightshades (ANS) (*Solanum nigrum* L.) are among the most widely distributed and consumed traditional vegetables. The current study was conducted to better understand the cultural variability in the use patterns and values of these vegetables. The study was conducted in Kisii, Kakamega and Nakuru counties of Kenya. Data was collected on ANS utilization using a survey of 630 ANS farmers, 6 focus group discussions and 9 key informant interviews. The results indicated that the ~~the~~ vegetable plays an important role in the communities as food (100%), medicine (78%) and spiritual (9%) use. As medicine, 75-85% of the respondents used the ANS to treat worms, stomach ache, diarrhea and ulcers. Additionally, ANS was used to treat eye infections (65%), boils and wounds (57%) and constipation (54%). The plant parts used for medicinal purposes were leaves (90%) shoots (66%), fruits (35%) and roots (25 %). These findings demonstrate that ANS is an important vegetable with multiple uses across the counties surveyed. ~~The~~is study underscores the need to document and preserve indigenous knowledge on utilization of ANS for promotion in conservation and commercialization, and future scientific research on the plants' efficacy and safety.

KEYWORDS: African nightshade, Utilization, Kenyan communities, Conservation, Commercialization

INTRODUCTION

In Kenya, the African nightshades (ANS) (*Solanum nigrum* L.) are among the most highly distributed and widely consumed traditional leafy vegetables (TLVs) (Abukutsa-Onyango, 2011). However, they have other uses depending on the community. Shei (2008) working on native west African vegetables found out that they have profound nutritional, economic and medicinal potential which if well exploited would possibly open ~~up~~ new markets for the global commercialization of the vegetables, encourage the local and global cultivation, consumption and conservation of especially those which are presently facing the threat of extinction. Two thirds of the Kenyan population live in rural areas and depend directly on

well-functioning ecosystems and biodiversity. The African nightshades (ANS) (*Solanum nigrum* L.) are among the TLVs that are the most affordable and sustainable dietary sources of vitamins, minerals and other bioactive compounds for the rural people. They have been reported to be particularly rich in pro-vitamin A (β – carotene) and vitamin C, crude proteins, fibre and the minerals potassium, phosphorous, calcium, iron and zinc (Akindahunsi and Salawu., 2005). Besides, traditionally, these vegetables are traditionally mainly grown by women (Onyango et al, 2016) hence are a source of food and income to them ensuring the health of the home and a form of financial independence from their husbands. However, in recent more recently times, there has been an emerging trend of men getting involved in the production and sale of the vegetable having identified it as source of income (Onyango et al, 2016). The current study was conducted to document indigenous local uses and traditions related to African nightshades to better understand cultural variability in use patterns and use values of these vegetables for conservation and commercialization.

METHODS

The study was carried out in representative counties, Kisii, Kakamega and Nakuru, of Kenya. Kisii and Kakamega counties lie in the south Western and western parties of Kenya respectively while Nakuru County is located in the Rift Valley of Kenya. The study entailed a survey of 630 ANS farmers and consumers (210 farmers in each of the three counties) randomly sampled in purposively selected sub-counties in each of the three counties. These sub-counties were Kisii Central and Gucha in Kisii County; Shinyalu and Navakholo in Kakamega County, and Molo and Nakuru West in Nakuru County.

In addition, a qualitative approach constituting of focus group discussions and key informants were was also used. The aim of this approach was to complement the survey by attempting to understand ANS utilization through the eyes of the main actors, namely, producers and consumers in order to document the application of indigenous knowledge in the utilization of ANS. The focus groups were derived from existing ANS production and consumers groups. The focus group discussion process involved a facilitator using a focus group discussion guide to moderate the discussion with a rapporteur writing notes. The facilitator used the Kiswahili language and the participants responded in Kiswahili. In Kakamega, the focus group constituted six participants all men who produced and marketed ANS together. They were all literate, aged between 28 and 61 years, and were all from Shinyalu Sub-county. Part of result The participants had been producing ANS for over ten years by the time they participated in the focus group discussion. Part of results unless it was part of criteria for

selection In Nakuru, the focus group discussion process was the same as in Kakamega. The group was composed of nine members all women aged between 40 and 65. In Kisii, the focus group was composed of six participants all women aged between 42 and 63. Part of results unless it was part of criteria for selection

Key informant interviews were conducted in the three counties with a view to bring in knowledgeable producers/consumers and community leaders including traditional healers, agricultural extension officers and teachers. The process entailed using a checklist of questions covering production, crop management and seed practices, postharvest handling and utilization to guide the interview, but remaining open enough to capture opinions, deep-rooted beliefs and practices. In Kakamega a male traditional healer, an agricultural officer and a female vegetable vendor in Shinyalu Market were the key informants. In Nakuru, an agricultural officer, a male ANS producer and a vegetable trader were interviewed. In Kisii a male producer and consumer aged 92, a female vegetable vendor and a male retired teacher were interviewed. Too elaborate. Readers know what key informants are and you need not give reasons why using them

Data analysis

The quantitative data were statistically analyzed for means and frequencies using SPSS version 15.0(SPSS, 2006). Qualitative data analysis in this study entailed examining the text produced from each key informant and focus group discussion for key themes and patterns that brought out the knowledge on ANS utilization in the respective communities. The idea was to bring out what Silverman (2003) calls ‘cultural stories’ namely retrieving the rhetorical force of what interviewees say. This meant taking the interviewees’ descriptions and statements beyond conventional meanings into contextual constructions that reflect the social and cultural meanings of ANS in the farm, plate, market and ritual. This line of analysis followed Richardson’s (2003) argument that ‘language does not reflect social reality, but produces meaning, creates social reality. Therefore the language and discourse in which ANS was presented offered varying and often competing meanings of the vegetable. The search for themes and patterns was carried out manually through reading and mapping the text data that emerged from the conversations and discussions involved in data collection. Once these themes and patterns were teased out they were compared across counties and cultures and the various meanings they encapsulated discussed. Vignettes from the corpus of data are used to illustrate themes or bring out emerging meanings and understandings. In your thesis write-up you can go into such details but for journal article you summarise the

analysis. The results and interpretation of results will give all the reasons you are giving here.
These are all not necessary for journal article

RESULTS AND DISCUSSION

Uses of African nightshades (ANS)

The results ~~qualitative data~~ revealed several ~~a number of~~ ANS uses i.e. food, medicinal and spiritual (Table 1). Across the three communities, ANS was mainly used as food (100%), while 84% (Nakuru), 87% (Kisii) and 65% (Kakamega) of the respondents used ANS for medicinal purposes. Besides, 14% (Nakuru), 13% (Kisii) and 1% (Kakamega) used it for spiritual purposes. Repetition of results in tabular and text format. Describe the results. What trends can you observe? Eg Unlike in Nakuru where over 80% of respondents use ANS for, in Kakamega only about 64% of respondents use for medicine. Describe the results

The household uses of ANS in the three communities under study were in a state of flux because of social change. The ‘traditional’ household that stuck together and consumed food from the same kitchen (Guyer, 1981) has largely given way to a ‘confederation of households’ (Alderson-Smith, 1984) where households coalesce from time to time to share in production and consumption. A more accurate presentation of the character of households nowadays is one of ‘virtual households’, where some members are on the farm offering labour and management, and others s in cities within the country and abroad providing capital, technical skills and valuable information; and sharing in the consumption of farm produce. Therefore, the uses of ANS in the three communities have to be analysed and understood in the context of ‘virtual households’. This concept of ‘virtual households’ implies that preparation and conservation of ANS leaf for consumption depends significantly on where household members are located spatially on the globe. If, some of the members are ~~located~~ in urban areas such as Nairobi, fresh ANS leaf are delivered by courier to them once or twice a week. ~~If~~ If, however, these members are ~~located~~ resident in Europe, Asia or North America, indigenous methods of preparation and preservation are used and the leaf is dried, packed and shipped ~~abroad~~ to the household members (personal communication during focus group discussions).

Consumption

Overall, it was commonly agreed across the three counties that ANS consumption was more prestigious than for instance kale or cabbage ~~consumption~~. This is because kale was mass produced and not preferred by most adults who in the words of one key informant from Kisii

County 'felt that it was forced on them because it was available in abundance'. ANS was generally said to be more palatable for adults and especially the aged. Besides being palatable ANS was harder to produce and thus more expensive than kale or spinach in the market. The finding that ANS consumption is considered more prestigious and preferred in all three communities under study contradicts Ambrose-Oji's (2009) that African indigenous leafy vegetables were mostly associated with 'hunger' or 'famine' foods and that it was considered humiliating to eat them.

Preparation methods for consumption

Different cooking methods were used by the three communities involved in the study (Table 2). In Nakuru, it was mainly boiled, fried with onions and tomatoes, and added milk and cream then served as stew. The consumers in Kakamega (62%) and Kisii (49) largely used the modern cooking method that entails boiling and frying of the vegetable compared to 23% in Kakamega and 44% in Kisii who used the traditional method that involves boiling the vegetables and adding milk (Table 2). The consumers in Nakuru were largely cosmopolitan with 54% boiling and adding milk to the vegetable while 30% boiled and fried the vegetables before consumption. A key informant from Nakuru County indicated that some of the consumers especially diabetics used more indigenous methods such as boiling and adding milk, and therefore did not fry nor add salt as they were advised against that on medical grounds.

The variety of ways in which Solanum leaf was cooked (Table 2) was discussed in the focused groups in which the use of potatoes, tender gourds, pumpkins and blood to alleviate bitterness was indicated to be practiced in Kisii County practices that did not show up in the survey. Except for boiling, and boiling and adding milk/cream the rest of the methods of ANS leaf preparation revealed in the discussions revolved around frying and were thus relatively recent and hence considered modern. This could be due to little knowledge being passed from the old who are more knowledgeable to the young who are less knowledgeable in the traditional cooking methods.

In Kakamega County, focus group discussion participants summarised the preparation of ANS for food as follows:

163 *People prepare ANS leaf for consumption in a variety of ways depending on the*
164 *resources at their disposal. Those who have resources boil, fry with onions, tomatoes*
165 *and spices and add milk and salt to taste. Most local consumers boil and add salt and*
166 *milk only. However, most men prefer the bitter dark variety boiled and add salt to*
167 *taste. They eat it that way as it relieves them from craving for it and ~~also~~ in that form*
168 *it defies any poor appetite.*

169 The foregoing vignette brings out three important points on ANS as food among the Luyhia
170 of Kakamega County. First, that preparation of the vegetable for consumption follows social
171 status characteristics with those less endowed with resources eating it more or less plain and
172 the more advantaged putting more additives to the ANS pot. Nonetheless, the vegetable was
173 available for food to people of all walks of life. Second, ANS preparation also followed a
174 gender character in which, men prefer to eat the bitter variety and choosing to deliberately
175 retain the bitterness on their palates. This preference brings out the inclination of rural men in
176 the county to underscore their “macho” character and differentiate themselves from women.
177 Third, ANS as consumed by the men was a response to a certain kind of craving and only a
178 particular variety could answer to that. **Additionally, the fact that it defied poor appetite**
179 **means that it was good for people suffering from malaria or recovering from that disease,**
180 **implying the medicinal value of the vegetable.** Are you deducing? Is poor appetite only
181 attributed to malaria? What diagnosis have you done to justify this?

182 In Kisii County, the Abagusii generally had many ways of treating bitterness in all
183 indigenous vegetables and especially ANS. A key informant said that after boiling ANS any
184 of the following could be added to make it more palatable – boiled sweet potato tubers, milk,
185 boiled pumpkin, immature gourd or blood. Traditionally, the results indicated that raw blood
186 was the most commonly used to make ANS more delicious and only the poor who did not
187 have cattle whose veins they could rapture with arrows and drain blood were unfortunate
188 enough to eat ANS plain or with less prestigious additives. Nowadays, people who fry ANS
189 may feel as privileged as those who used blood in ANS preparation in the past. Therefore, the
190 issue of social status has always been critical in the preparation of ANS for consumption.
191 Either the more affluent among the Abagusii have always dominated the discourse around
192 how best to prepare vegetables whether it was about using blood or vegetable cooking oils; or
193 their way of preparing it has always been the standard and thus what the majority aspired to
194 achieve. Whatever the explanation, cooking vegetable oil had largely replaced blood as the
195 most prestigious additive among the relatively affluent in Kisii County.

Vegetables are mainly cooked before consuming to improve palatability, texture and taste (Migliot et al. 2008) as well as to eliminate potential pathogens or to neutralize poisonous or irritating substances (Martin and Meitner, 1998). Cooking methods used are mainly based on convenience and taste preference rather than nutrient retention (Gaofeng et al. 2009). Some cooking methods such as those used by the communities in this study may oxidize antioxidants (Shahnaz et al., 2003) and affect the vegetable nutrient retention.

Medicinal uses

In terms of medicinal uses, the three communities identified the use of ANS to treat stomach ache, ulcers, worms, constipation, diarrhea, boils, wounds, swollen glands and eye infections (Figure 1). Majority of the respondents (75-85%) used the ANS to treat worms, stomach ache, diarrhea and ulcers (Figure 1).

Among the Abagusii one of the focus group discussion participants described use of Solanum as follows:

“The leaves of the traditional variety of Solanum known as Oara whose leaves are dark green and rough are used in treating some fungal skin infections. The leaves are dried under shade or indoors and then burnt out in a pot until it forms ash. The ash is mixed with Night rose Baby Jelly (a commercial body cream) and applied on affected skin”.

In another focus group discussion in Kisii county the participants indicated that: *“consumption of the Oara type of ANS reduces stress and malaria patients use it as it is bitter and they prefer it as they recuperate with low appetite”.*

Overall, among the Abagusii ANS was physically applied to cure fungal skin diseases (e.g. *Psoriasis versicolor*); although the process of preparation of the medicine implies that the potency of the ANS is activated through burning it into ash. The ash ought to be tested in a laboratory to reveal the properties therein and determine whether or not they have any bearing in dealing with active fungi on the human skin. While this possibility exists, the healing power of the ash was explained in terms of ‘feeding the skin’ to rejuvenate it. This implies that the application was founded more on belief than actual chemical property known to work on the fungi. In terms of reducing stress the key attribute in the ANS celebrated as working on stress was its bitterness. What is the meaning? It was the case also with regard to its use by recuperating malaria patients. It is believed that The the bitterness helped patients overcome nausea which they said was aggravated by sweetness in food.

227 Participants in the Kalenjin focus group discussion argued as follows:

228 *“The bitter dark green and rough leaf of the ANS is tough on alcohol related*
229 *hangover. The leaves are boiled with salt and pepper without any oil and the dark*
230 *soup given to the person to drink and “he goes to work fresh”. The soup also relieves*
231 *joint pains”.*

232 Therefore, the Kalenjin like other African communities did not use ANS only for food; they
233 explored its medicinal uses and were not disappointed.

234 The use of different traditional vegetables for medicinal purposes has been reported in Kenya,
235 with some of the vegetables indicated to cure more than one ailment (Kimiye et al., 2007).
236 For ~~exampleexample~~, some communities have indicated that spider plant (*Cleome gynandra*)
237 can relieve constipation and facilitate child birth (van den Heever and Venter, 2007) while
238 African nightshade (*Solanum scabrum*) can be used to cure stomach ache (Adesina and Gbile,
239 1984).

240 Besides, they are known to contain substantial amounts of antioxidants that scavenge for and
241 bind to harmful radicals, which have been linked to ailments such as cancer, diabetes and
242 cardiovascular diseases (Abukutsa-Onyango, 2011, Onyango et al. 2012). The current study
243 also found out that ANS were used by the communities not only as food but also for medicine
244 and health benefits. This is important for interventions focussed on encouraging communities
245 to increase the consumption and utilization of indigenous leafy vegetables as well as analysis
246 of the vegetable for their medicinal properties. Recast this sentence and break into two. You
247 seem to be making recommendation

248 Different parts of the vegetable were used for the treatment of the ailments. Majority of the
249 people interviewed used leaves, shoots, fruits and roots for the treatment of different ailments
250 (Figure 2).

251

The use of different plant parts for medicinal purposes is an old practice among different communities in Kenya and in most parts of the world (<http://www.bioversityinternational.org/>). Otieno and Analo (2012) reported that local people mainly use leaves, roots and barks for the treatment of ailments. Medicinal properties from plants can be obtained from many different parts of a plant; leaves, roots, bark, fruit, seeds and flowers. The different parts of a plant can contain different concentrations or active ingredients. Hence, one part could be toxic while another part of the same plant could be harmless (USDA).

Spiritual use

The Abaluyhia of Kakamega County had a unique use for ANS. Participants in a focus group discussion in the county narrated:

“When a male elder wants to pronounce a curse on an offender, they boiled leaves from the dark bitter variety of Solanum adding nothing to it except water. Once it was well boiled and ready for consumption and cooled off well, the elder put some of the vegetable and its dark bitter soup in the mouth and confront the offender pronouncing the curse with stuff still in his mouth. Once done with pronouncing the curse, he spat the contents off and walked away without looking back. This works as long as the elder deploying the curse is avenging a real offence on himself or somebody else, and not acting maliciously”.

The primacy of ANS in deploying a curse among the Luyhia of Kakamega implies that the vegetable transcends its normal physical nature to enter the spiritual realm ~~in order~~ to provide the necessary medium for transmitting the curse. When the physical form recedes to give way for the spiritual, the elder deploying the curse also apparently transforms and is momentarily consumed into the spiritual world until the function of deploying the curse is completed. **It would also appear from the evidence adduced in the vignette that the spiritual potency in ANS leaves is dependent on the genuineness of the offence being avenged and thus could not be used for witchcraft which usually constitutes malice and envy.** What is the meaning of this? Communicate your ideas well to the reader One can also argue that since offences on a third party can be avenged, ANS as a tool for spiritual combat may be out-sourced by women to males to avenge for them.

While it is difficult to ascertain the science in the claims made, the fact that the ANS worked for communities in the manner described shows that the utility of the vegetable was beyond

its known food value and that the intentions of the cultivators are varied and all valid according to their knowledge bases and needs. Communicate your ideas in clear plain words for the reader to understand

CONCLUSIONS

African nightshades play an important role in the communities being used as food, medicine and spiritual purposes. There exists knowledge albeit diverse on utilization of African nightshades (*Solanum nigrum* L) among the Abagusii, Abaluhya and Kalenjin communities.

This knowledge is, however, being lost as it is not documented and only passed on to younger generations by the older members of the society. How is it pass from generation to generation? This study underscores the need to document and preserve knowledge on utilization of traditional vegetables such as African nightshades for promotion in conservation and possible commercialization, future scientific research on the plants' efficacy and safety. Further, the knowledge will be used in extension, promotion and conservation of the vegetable. You are not giving reasons for the study. The conclusion is summarising the deductions from your study.

REFERENCES

- Abukutsa-Onyango, M.A. (2011). 'Researching African Indigenous Fruits and Vegetables – Why?' <http://knowledge.cta.int/> Accessed 4th February 2016
- Adesina, S.K. and Z.O. Gbile, (1984). 'Steroidal constituents of *Solanum scabrum* subsp. *Nigericum*'. *Fitoterapia* 55 (6) pp. 362-363.
- Alderson-Smith, G. (1984) 'Confederations of Households: Extended Domestic Enterprises in City and Country'. In Long, N. and B. Roberts (Eds.) *Miners, Peasants and Entrepreneurs: Regional Development in the Central Highlands of Peru*. Cambridge: Cambridge University Press.
- Ambrose-Oji, B. (2009) 'Urban Food Systems and African Indigenous Vegetables: Defining the Spaces and Places for African Indigenous Vegetables in Urban and Peri-Urban Agriculture', in C.M. Shackleton, M.W. Pasquini and A.W. Drescher (Eds.) *African Indigenous Vegetables in Urban Agriculture*. London & Sterling, VA: Earthscan.
- Gao-feng, Y. Bo, S. Jing, Y. and Qiao-mei, W. (2009). Effects of different cooking methods on health-promoting compounds of broccoli, *Journal of Zhejiang University. Science. B.* 10 (8): 580-588

315 Guyer, J. (1981) 'Household and Community in African Studies'. *African Studies Review*,
316 24(2/3) pp.87-137.

317 Kimiywe J., J. Waudo, D. Mbithe and P. Maundu (2007). 'Utilization and Medicinal Value of
318 Indigenous Leafy Vegetables Consumed in Urban and Peri-Urban Nairobi'. *African Journal
319 of Food Agriculture Nutrition and Development*, 7(4) pp. 1-15

320 Martin, F.W. and Meitner R.L.S, (1998). Edible Leaves of the Tropic, Educational concerns
321 for Hunger organization, INC, PP 1 – 8.

322 Miglot et al. (2008) in: Tumwet TN, Kang'ethe, EK, Kogi-Makau. W and Mwangi AM
323 (2014) Diversity and Immune boosting claims of some African indigenous leafy vegetables in
324 Western Kenya. *African Journal of Food, Agriculture, Nutrition and Development*. 14(1) :
325 8529-8544

326 Onyango C.M., E.G. Ontita R.N. Onwong'a N. Desterio and J.R. Gapusi (2016). 'Status and
327 Production Practices of Vegetable African Nightshade (*Solanum nigrum* L.) in Selected
328 Communities of Kenya' Status and Production Practices of Vegetable African Nightshade
329 (*Solanum nigrum* L.) in Selected Communities of Kenya. *American Journal of Experimental
330 Agriculture* 13(3) pp. 1-12

331 Onyango C.M., J.Harbinson, J.K. Imungi, S.S. Shibairo and O. van Kooten (2012). 'Influence
332 of Organic and Mineral Fertilization on Germination, Leaf Nitrogen, Nitrate Accumulation
333 and Yield of Vegetable Amaranth', *Journal of Plant Nutrition*, 35(3) pp. 342-365

334 Otieno N.E. and C. Analo (2012). 'Local indigenous knowledge about some medicinal plants
335 in and around Kakamega forest in western Kenya' *F1000 Research*;1:40
336 doi:10.12688/f1000research.

337 Richardson, L. (2003) 'Writing: A Method of Inquiry' in Denzin, N.K. and Y.S. Lincoln
338 (Eds.) *Collecting and Interpreting Qualitative Materials*, Second Edition. Thousand Oaks,
339 London and New Delhi: Sage Publications, PP. 499-541.

340 Silverman, D. (2003) 'Analysing Talk and Text' in Denzin, N.K. and Y.S. Lincoln (Eds.)
341 *Collecting and Interpreting Qualitative Materials*, Second Edition. Thousand Oaks, London
342 and New Delhi: Sage Publications, PP. 340-362.

343 Shahnaz et al., (2003), Effect of peeling and cooking on nutrients in vegetables, Pakistan
344 Journal of Nutrition, 2(3): 189 – 191.

345 Shei, L. C. (2008). An Evaluation of Native West African Vegetables. Paper presented at the
346 Conference on International Research on Food Security. University of Hohenheim, October
347 7-9, 2008

348 van den Heever, E. and S.L. Venter (2007). 'Nutritional and medicinal properties of Cleome
349 gynandra' *Acta Horticulturae* 752 pp.127-130.
350 Wemali, E.N.C. (2014) 'Contribution of Cultivated African Indigenous Vegetables to Agro-
351 Biodiversity Conservation and Community Livelihood in Mumias Sugar Belt, Kenya'. An
352 Unpublished PhD Thesis, School of Environmental Studies, Kenyatta University.
353 USDA- <http://www.fs.fed.us/wildflowers/ethnobotany/medicinal/parts>). Accessed 5th
354 October 2016

355 **LIST OF TABLES**

356

357

358 **Table 1: Main uses of African nightshade in Kisii, Kakamega and Nakuru Counties**
 359 **(N=210)**

County	Indigenous uses (% use)		
	Food	Medicinal	Spiritual
Nakuru	100	84	14
Kisii	100	87	13
Kakamega	100	65	1
All Counties	100	78	9

360

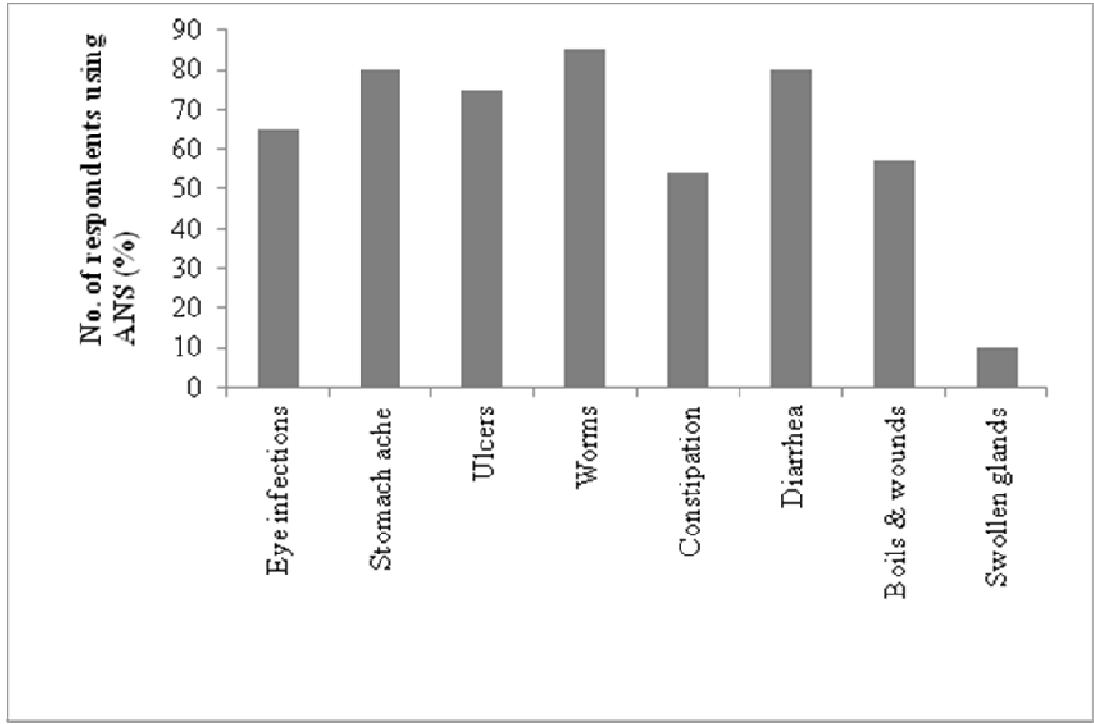
361

Table 2: Methods of preparation of African nightshade for Consumption in Nakuru, Kisii and Kakamega Counties (N=210)

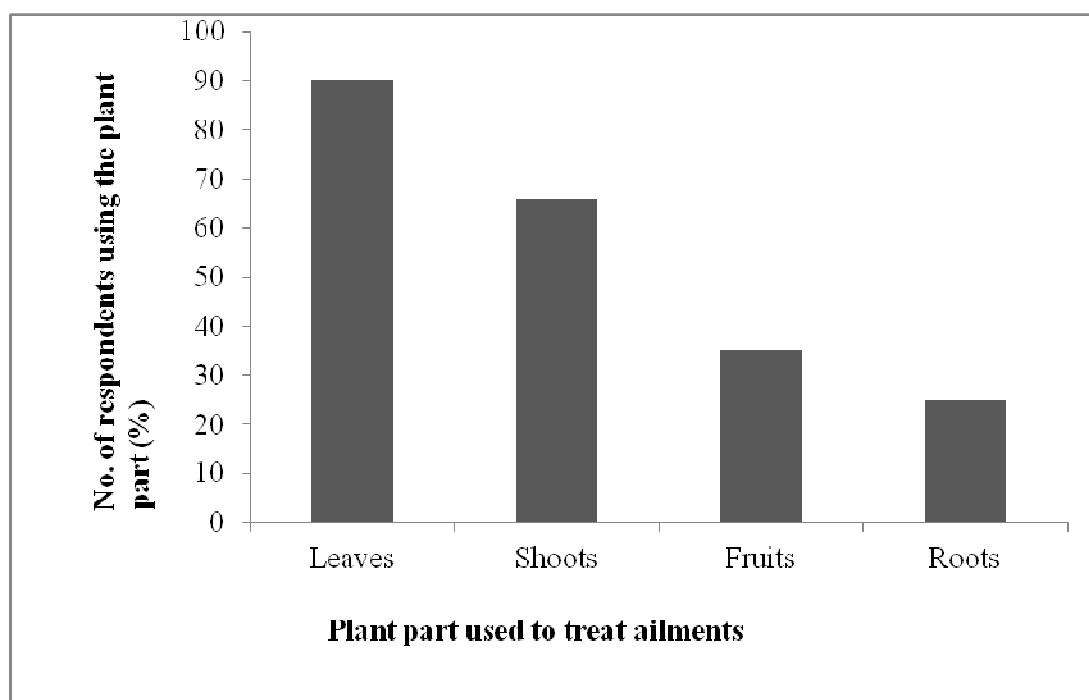
County	Preparation of vegetables for consumption (% respondents)					
	Boil	Fry without washing	Boil & fry	Boil & add milk/cream	Boil, fry & add milk/cream	Wash & fry
Nakuru	3	5	30	54	7	1
Kisii	1	3	49	44	3	0
Kakamega	5	5	62	23	3	2
All counties	3	5	47	40	4	1

LIST OF FIGURES

Figure 1: The different medicinal uses of African nightshades in the three Kenyan communities (N=610)



375 **Figure 2: The parts used in the treatment of different ailments (N=630)**



376
377
378