

## **Indigenous Knowledge on the Uses of African Nightshades (*Solanum nigrum* L.) Species among Three Kenyan Communities**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. Author EGO and CMO designed the study, wrote the protocol and wrote the first draft of the manuscript. Author RNO and DN reviewed the experimental design and all drafts of the manuscript. All authors read and approved the final manuscript.*

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### **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

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utilization using a survey of 630 farmers, 6 focus group discussions and 9 key informant interviews. The results indicated that 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 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.*

## 1. INTRODUCTION

In Kenya, the African nightshades (ANS) (*Solanum nigrum* L.) are among the most highly distributed and widely consumed traditional leafy vegetables (TLVs) [1]. However, they have other uses depending on the community. Shei [2] working on native west African vegetables found out that they have profound nutritional, economic and medicinal potential which if well exploited would possibly open 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 ( $\beta$  – carotene) and vitamin C, crude proteins, fibre and the minerals potassium, phosphorous, calcium, iron and zinc [3]. Besides, these vegetables are traditionally grown by women [4] 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 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 [4]. The current study was conducted to document indigenous 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.

## 2. 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 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, focus group discussions and key informants were also used. The focus groups were derived from existing ANS production and consumer groups. 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. The participants had been producing ANS for over ten years by the time they participated in the focus group discussion. 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. 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. In Kakamega a male traditional healer, an agricultural officer and a female vegetable vendor 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.

## 2.1 Data Analysis

The quantitative data were statistically analyzed for means and frequencies using SPSS version 15.0 [5]. 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 [6] 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 [7] 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. Vignettes from the corpus of data are used to illustrate themes or bring out emerging meanings and understandings.

## 3. RESULTS AND DISCUSSION

### 3.1 Uses of African Nightshades (ANS)

The results revealed several ANS uses i.e. food, medicinal and spiritual (Table 1). Across the three communities, ANS was used as food by all respondents and for medicinal purposes by the majority. Unlike in Nakuru and Kisii where 14% and 13% respectively used ANS for spiritual purposes in Kakamega only 1% put the vegetable to that use. ANS was therefore mainly grown for food. 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 [8] 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 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 in urban areas such as Nairobi, fresh ANS leaf are delivered by courier to them once or twice a week. If, however, these members are resident in Europe, Asia or North America, indigenous methods of preparation and preservation are used and the leaf is dried, packed and shipped to the household members (personal communication during focus group discussions).

### 3.2 Consumption

Overall, it was commonly agreed across the three counties that ANS consumption was more prestigious than for instance kale or cabbage. 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 demanding 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 [9] that African indigenous leafy vegetables were mostly associated with 'hunger' or 'famine' and that it was considered humiliating to eat them.

### 3.3 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. More consumers in Kakamega (62%) and Kisii (49) used the modern cooking method that entails boiling and frying the vegetable compared to Nakuru where 54% of the respondents used the traditional method of boiling and adding milk to the vegetable. 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 in traditional methods of cooking ANS 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:

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

The foregoing vignette brings out three important points on ANS as food among the Luhya of Kakamega County. First, that preparation of the vegetable for consumption follows social status characteristics with those less endowed with resources eating it more or less plain and the more advantaged putting more additives to the ANS pot. Nonetheless, the vegetable was available for food to people of all walks of life. Second, ANS preparation also followed a gender character in which, men prefer to eat the bitter variety and choosing to deliberately retain the bitterness on their palates. This preference brings out the inclination of rural men in the county to underscore their “macho” character and differentiate themselves from women. Third, ANS as consumed by the men was a response to a certain kind of craving and only a particular variety could answer that. Additionally, the fact that it defied poor appetite means that it was good for people suffering in or recovering from ill-health and poor appetite therein, implying the medicinal value of the vegetable.

In Kisii County, the Abagusii generally had many ways of treating bitterness in all indigenous

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

Vegetables are mainly cooked before consuming to improve palatability, texture and taste [10] as well as to eliminate potential pathogens or to neutralize poisonous or irritating substances [11]. Cooking methods used are mainly based on convenience and taste preference rather than nutrient retention [12]. Some cooking methods such as those used by the communities in this study may oxidize antioxidants [13] and affect the vegetable nutrient retention.

### 3.4 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 (Fig. 1). Majority of the respondents (75-85%) used the ANS to treat worms, stomach ache, diarrhea and ulcers (Fig. 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* (*Solanum nigrum* subsp. *nigrum* L.) 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”.

without any oil and the dark soup given to the person to drink and “he goes to work fresh”. The soup also relieves joint pains”.

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”.

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

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. It is believed that the bitterness helped overcome stress which they said was aggravated by sweetness in food.

The use of different traditional vegetables for medicinal purposes has been reported in Kenya, with some of the vegetables indicated to cure more than one ailment [14]. For example, some communities have indicated that spider plant (*Cleome gynandra*) can relieve constipation and facilitate child birth [15] while African nightshade (*Solanum scabrum*) can be used to cure stomach ache [16].

Participants in the Kalenjin focus group discussion argued as follows:

“The bitter dark green and rough leaf of the ANS is tough on alcohol related hangover. The leaves are boiled with salt and pepper

Besides, they are known to contain substantial amounts of antioxidants that scavenge for and bind to harmful radicals, which have been linked to ailments such as cancer, diabetes and cardiovascular diseases [1,17]. The current study also found out that ANS were used by the communities not only as food but also for medicine and health benefits. This is important for interventions focussed on encouraging communities to increase the consumption and utilization of indigenous leafy vegetables. This finding also points to the need for analysis of the vegetable for their medicinal properties.

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

**Table 1. Main uses of African nightshade in Kisii, Kakamega and Nakuru counties (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         |

**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          |

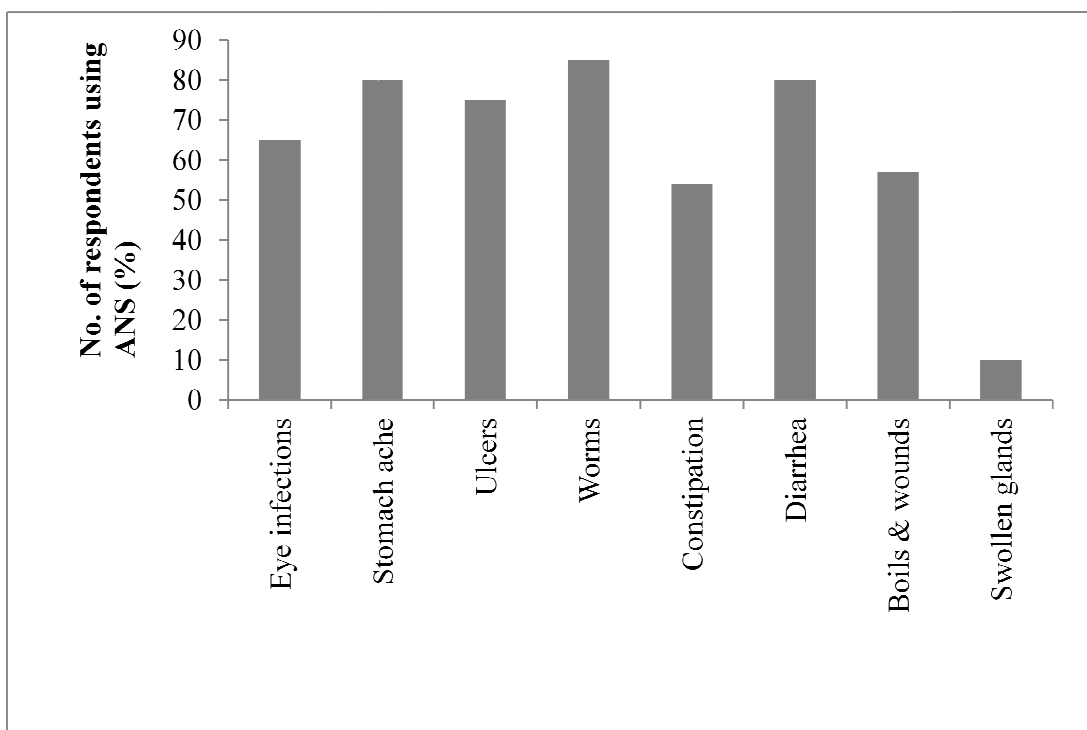


Fig. 1. The different medicinal uses of African nightshades in the three Kenyan communities (N=610)

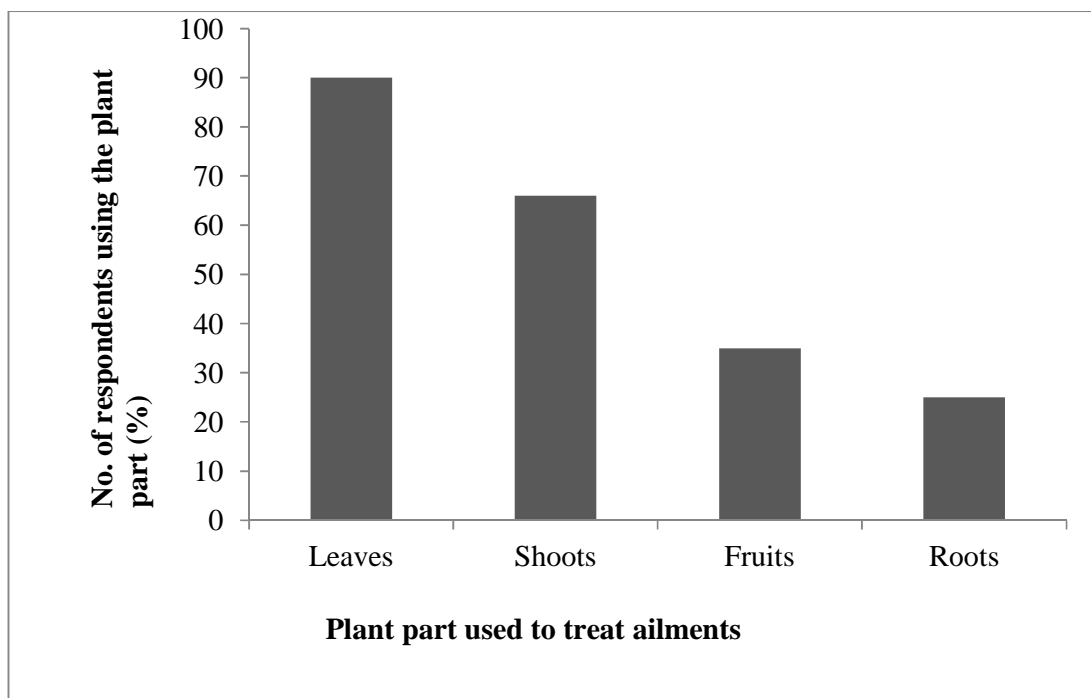


Fig. 2. The parts used in the treatment of different ailments (N=630)

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 [18]. Otieno and Analo [19] 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 [20].

### 3.5 Spiritual Use

The Abaluhya 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 Luhya of Kakamega implies that the vegetable transcends its normal physical nature to enter the spiritual realm 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. Therefore, the spiritual use of the vegetable could not be used for witchcraft which usually constitutes malice and envy. 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.

## 4. CONCLUSIONS

African nightshades play an important role in the communities being used for 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 ineffectively passed on to younger generations by the older members of the society by word of mouth and practice. 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.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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