Traditional Medicinal vegetables in Northern Uganda. An ethnobotanical survey.

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Abstract

Background A wide range of indigenous vegetables grow in Uganda especially during rainy seasons but scarcely during droughts, except those that are commercially grown. Although a number of these vegetables have medicinal values, they have not been satisfactorily studied besides conservation. Therefore, we conducted an ethnobotanical cross-sectional survey in Northern Uganda in order to document traditional vegetables and their medicinal values.

Methods An ethnobotanical survey was conducted in Northern Uganda using both qualitative and quantitative data collection approaches to data collection and analysis. Data was collected using semi-structured, interviewer-administered questionnaires following international ethical codes and key informant interviews using well developed key informant guides. A total of 244 individuals participated in the study.

Results The study documented forty five (45) traditional vegetables in Northern Uganda, out of which fifteen (15) also served as folk medicine. These included: Amalakwang (*Hibiscus sabdariffa*), Akeo (*Gynandropsis gynandra*), Alaju (*Asystasia gangetica*), Otigo (*Corchorus* spp.), Ocwica (*Cucubita maxima*), and Bojo (*Vigna unguiculata*) among others. The disease conditions managed using traditional vegetables in the study area included: gastrointestinal, reproductive, musculoskeletal complications as well as non-communicable diseases.

Conclusion Northern Uganda has numerous traditional vegetables with medicinal benefits such as gastrointestinal, reproductive and musculoskeletal abnormalities. The community obtains vegetable leaves from the backyard and stews them for the medicinal purposes. However, there was no specific dosage administered. Therefore, we recommend studies to standardize the dosages and verify in laboratory models the efficacy of these vegetables.

Introduction

Despite the aggressive rivalry from conventional medicines, natural products have remained drugs of choice for some individuals due to their safety and efficacy (1). Individuals prefer to use traditional medicines because of affordability and accessibility; desire for personalized health care and fear for adverse events associated with synthetic drugs (2, 3). Usage also surges when conventional medicines are ineffective in the treatment of diseases such as cancer, and in the face of new infectious diseases (4, 5). Traditional medicines of plant origin are used by about 80% of persons in the developed countries (6, 7). More than 30% of the modern pharmacological drugs have their origin directly or indirectly linked to plants (8, 9). An estimated 25% of the drugs prescribed worldwide are derived from plants (10) and out of the total 252 drugs in the World Health Organization's (WHO) essential medicine list, 11% are exclusively of plant origin (1, 11). Moreover, 80% of 122 plant derived drugs have their uses related to their original ethnopharmacological purposes (12).
Traditional leafy vegetables worldwide are a valuable and cheap source of nutrition for a balanced diet (13). In addition, these vegetables serve as folk medicines (13) for treating conditions such as toothache (Amaranthus viridis L.), acute abdominal pain (Celosia argentea L.), painful urination (Portulaca oleracea L.), headache (Smithia sensitiva Ait.) and diarrhea (C. mimosoides L.) (13); rheumatism and cough (Marsilea minuta Linn), and helminthes infestation (Spinacia oleracea Linn.) (14).

In Uganda, traditional vegetables are plant species which are either native or were introduced into the country a while ago and are presently being cultivated and their leaves used as a sauce to the staple foods (15, 16). Diverse species grow in all the geographical regions of the country. However, their level of cultivation and consumption differs depending on the local customs, beliefs, practices and staple foods of the folks as well as soil /climate types (15). Some of these traditional vegetables have been domesticated whereas others grow and are gathered as wild or semi-wild floras (15, 16). Domesticated vegetables are planted in home-based gardens (backyards) with trivial devotion in their production. The production of traditional vegetables is suitable for several families as they grow within a short time period shortly after the start of rains subsequent to dry seasons (15). Further, traditional vegetables are a major source of ascorbic acid and various micronutrients in the diet (16, 17) in Uganda. The vegetables contain: vitamins (A, B, and C); proteins and minerals such as iron, calcium, phosphorus, iodine and fluorine in varying amounts but adequate for normal growth and health (17). According to the FAO Food Balance Sheet for Uganda, traditional food plants supply about 90% energy, 76% protein and 63% fat, and most of vitamins A and C, iron and dietary fiber (15). These food values are vital necessities for normal growth and defense against protein/calorie malnutrition in humans (15). Traditional vegetables ensure a well-balanced diet in rural areas (13). In some cases, parts of traditional vegetable species serve as staple foods such as: the mature fruits of C. maxima and the tubers of C. benghalensis, Ipomoea spp., M. esculenta and S. edule.

Not only are these traditional vegetables a source of food, they are as well used for medicinal purposes. For example, prevention of blindness especially in children using vitamin A found in all dark green leafy traditional vegetables such as Amaranthus (dodo), Solanum aethiopicum (Nakati), Manihotesculenta (cassava leaves) and Ipomea batatas (sweet potato leaves). On the other hand vegetables like Solanum indicum subsp. distichum (Katunkuma) are believed to control high blood pressure (17). According to a study carried out at Mwana mugimu Nutrition Services, traditional vegetables were identified as a critical nutritional resource (especially in children) (18). The study suggested that families should make nutritious foods for young babies using locally available foods, including traditional vegetables in the fight against malnutrition (15). In addition, the leaves of B. pilosa are used for wounds and boils while the juice for various eye and ear problems and a decoction for rheumatism, stomach disorders and intestinal worms yet the roots for malaria treatment. Other important medicinal traditional vegetables include C. obtusifolia, Celosia argentea, C. benghalensis, Corchorus spp., G. abyssinica, Hibiscus spp., L. siceraria, L. cylindrica, S. indicum, S. indicum subsp. distichum, T. indica and Tribulus spp.(15). Traditional vegetables are also used to obtain various other products such as ornaments, dyes, tobacco and coffee substitutes, pipes, ropes, sacks, mats, containers, ladles, industrial oils including drug sponges, carriers, soil fertilizers and livestock feeds (15).
Whereas these traditional vegetables are easily accessible to the communities and would conveniently and cheaply be used in management of various disease conditions, studies regarding their medicinal uses are scanty in the country. Besides, there is poor and inadequate documentation of the traditional medicinal uses of most of these plants since it is often privately and verbally passed on from one generation to another. This leads to high risk of loss of information about these plants including their medicinal values (19, 20). In this study, we therefore set out to document the traditional vegetables in Northern Uganda with their medicinal uses through an ethnobotanical survey.

Methods

Study site and setting

Data was collected from the Lango sub-region, Northern Uganda. Northern Uganda as a region is divided into 5 sub-regions: Acholi, Karamoja, Lango, West Nile and Teso. There are several ethnic groups in the region such as Acholi, Langi and Ateso tribes. The region has a hot climate and the natives are majorly subsistence farmers. They mostly grow maize, soya beans, simsim, cassava, millet, ground nuts and beans. The residents typically eat starchy foods frequently accompanied by pasted green leafy vegetables of different kinds. They are fond of using plants including vegetables as traditional medicines for disease treatment. For instance, they use *Hibiscus spp* for the treatment of cough and the roots *Gynandropsis gynandra* to facilitate birthing. The northern region of Uganda has 30 districts with a total population of 7,188,139 and a total area of 85,391.7 km$^2$ (21).

Study design and sampling

A descriptive mixed method design was employed in the current study. Both quantitative and qualitative approaches of data collection and analysis were used to describe the medicinal uses of traditional vegetables in Northern Uganda in an ethnobotanical survey (22, 23). This was done to enable comprehensive data collection. A multi-stage simple random sampling technique (24) was used to select the units (i.e. sub region, district, sub-counties, parishes and villages) for quantitative data in order to properly portray the study area and be able to generalize the study outcomes. The sample units were selected by listing the names of all units (at each stage) on small pieces of paper which were mixed up. One piece was picked, its name noted down in a book and it was replaced in the pool. The process was repeated until all the units were identified. One sub-region, one district, four sub-counties, 2 parishes per sub-county and 6 villages from each parish and finally 5 households per village were selected. The study participants were selected based on the convenience sampling technique (24) for easy access. A sample size of 246 households (one person per household) was determined following a formula by methodology (25). Of these, five herbalists were selected using purposive and snowball techniques (24) for qualitative data. A total of 244 participants (one person per household) were interviewed.

Ethnobotanical Data Collection
Quantitative and qualitative data was collected using a semi-structured, interviewer-administered, questionnaires (26, 27) and key informant interviews (28) respectively. Interviews were conducted in the local language (Luo) using research assistants who were skilled undergraduates from the region (26). The data collection tool was designed to obtain details regarding the: sub-county, parish and village name; participant bio-data; commonly consumed vegetables (local names); vegetables with medicinal benefits; their therapeutic uses; plant part used; style of preparation; route of administration and quantity used (27). In addition, the participants were requested to mention the medicinal vegetables they most commonly used, the most effective (in their opinion) and the source of information regarding the medicinal value. This information was carefully recorded in the tool during the interviews. The data collection tool was pretested before use (29) to ensure content validity and the questionnaires were properly checked for completeness and correctness before leaving the field following data collection. A total of 244 persons were interviewed. Of these, 239 (165 female and 74 male) were community members while 5 (1 female and 4 males) were known herbalists (key informants). The herbalists were individually interviewed following a key informant interview guide generated for the study (28). The study participants were natives aged 45 years and above except for the key informants whose age was not regarded. Before conducting the interviews, the local area leaders were contacted to obtain permission for the study and informed consent was obtained from each participant. In addition, international ethical codes of conduct were ensured throughout the study (30). Further, the study was approved by Research and Ethics Committee (REC_MUREC 1/7) of Mbarara University of Science and Technology as well as the Uganda National Council for Science and Technology (UNCST). The scientific (botanical) names of the vegetables were obtained from previous studies of medicinal plants in the region.

**Data analysis**

The quantitative study responses obtained from the survey were coded and double entered into SPSS v.20 for a descriptive statistical analysis of frequencies and percentages. This was done in order to assess the significance of the vegetables in the study area. The information was summarized and reported in the form of figures and tables. Data obtained from key informants was grouped into themes and reported as quotations (31). In addition, the participants were tasked to mention the most common and therapeutically effective vegetable. Further, the informant consensus factor (ICF) was calculated to describe the effectiveness of the vegetable for each disease (32, 33) using the formula: 

\[
ICF = \frac{n-nt}{n-1}
\]

where \(n\) is the number of individual reports of a plant use for a particular illness while \(nt\) is the total number of species used by all informants for this illness. Furthermore, the fidelity level FL for the 10 commonly used vegetables for medicinal benefits was calculated as follows: 

\[
FL = \frac{Ip}{Iu} \times 100\%,
\]

where \(I_p\) is the number of informants who suggested the use of a species for the same major use (therapeutic) and \(I_u\) is the total number of informants who mentioned the plant species for any use (33).

**Results**

**Participant socio-demographics**
A total of 244 participants were involved in the current study. 239 were community members while 5 were herbalists. Majority were aged 45–49 (59.8%); females (68%); 96.3% of the Lango tribe; Roman Catholics (56.9%); of primary level (51.6%) and farmers (91.4%) [Table 1].

Table 1
Participants’ Socio-demographics profile

| Variable          | Description       | Frequency | Percentage |
|-------------------|-------------------|-----------|------------|
| Age               | 45–49 years       | 146       | 59.8       |
|                   | 50–54 years       | 38        | 15.6       |
|                   | 55–59 years       | 18        | 7.4        |
|                   | 60 and above      | 42        | 17.2       |
| Gender            | Female            | 166       | 68.0       |
|                   | Male              | 78        | 32.0       |
| Tribe             | Lango             | 235       | 96.3       |
|                   | Acholi            | 6         | 2.5        |
|                   | Alur              | 1         | 0.4        |
|                   | Bantu             | 2         | 0.8        |
| Religious affiliation | Anglican       | 77        | 31.8       |
|                   | Roman Catholic    | 139       | 56.9       |
|                   | Moslem            | 2         | 0.8        |
|                   | Pentecostal       | 25        | 10.5       |
|                   | Other             | 1         | 0.4        |
| Education level   | Informal          | 77        | 31.6       |
|                   | Primary           | 128       | 52.5       |
|                   | Secondary         | 35        | 14.3       |
|                   | Other             | 4         | 1.6        |
| Source of income  | Subsistence Farming | 223     | 91.4       |
|                   | Business          | 12        | 5.0        |
|                   | Formal employment | 6         | 2.5        |
|                   | Other             | 3         | 1.2        |
Traditional Vegetables In Northern Uganda

There were a total of 45 traditional vegetables were documented in Northern Uganda. The list (local names) is provided in Table 2. The scientific names were obtained from previous studies.
| S/N | Local name     | Scientific/ family name | Frequency | Percentage |
|-----|----------------|-------------------------|-----------|------------|
| 1   | Amalakwang     | *Hibiscus spp*          | 220       | 92.1       |
| 2   | Bojo           | *Vigna unguiculata*     | 225       | 94.1       |
| 3   | Alaju          | *Crotalaria ochroleuca G.Don /Fabaceae* | 205   | 85.8       |
| 4   | Acwica         | *Cucurbita maxima D/ Cucurbitaceae* | 190   | 79.5       |
| 5   | Otigo          | *Corchorus spp*         | 231       | 96.7       |
| 6   | Birinyanya     |                         | 10        | 4.2        |
| 7   | Tula           | *S. gilo*               | 12        | 5          |
| 8   | Cabbage        | *Brassica oleracea*     | 107       | 44.8       |
| 9   | Nyanya         |                         | 8         | 3.3        |
| 10  | Akeo           | *Gynandropsis gynandra/ Cleomaceae* | 202   | 84.5       |
| 11  | Ocuga          | *Solanum americanum Mill. (Solanacea)* | 67    | 28         |
| 12  | Abuga          | *Amaranthus spp*        | 175       | 73.2       |
| 13  | Ocobo          |                         | 7         | 2.9        |
| 14  | Acwere         |                         | 4         | 1.7        |
| 15  | Aminatakara    |                         | 20        | 8.4        |
| 16  | Atiang tiang   |                         | 9         | 3.8        |
| 17  | Awica          |                         | 90        | 37.7       |
| 18  | Abura          |                         | 25        | 10.5       |
| 19  | Ayuu bap       | *Acalypha bipartite M*  | 47        | 19.7       |
| 20  | Opere          | *Colocasia esculenta*   | 46        | 19.2       |
| 21  | Adipakong      |                         | 47        | 19.7       |
| 22  | Burukula       |                         | 1         | 0.4        |
| 23  | Sukuma wiki    |                         | 16        | 6.7        |
| 24  | Agabo          |                         | 1         | 0.4        |
| 25  | Kamalala       | *Capsicum spp.*         | 17        | 7.1        |
| 26  | Apuruk         |                         | 20        | 8.4        |
| 27  | Amola          |                         | 3         | 1.3        |
| S/N | Local name  | Scientific/ family name                          | Frequency | Percentage |
|-----|-------------|-------------------------------------------------|-----------|------------|
| 28  | Orono       |                                                 | 2         | 0.8        |
| 29  | Akukuna     |                                                 | 1         | 0.4        |
| 30  | Oyado       |                                                 | 7         | 2.9        |
| 31  | Akorobonyo  |                                                 | 2         | 0.8        |
| 32  | Cabit       |                                                 | 3         | 1.3        |
| 33  | Acwewangweno|                                                 | 12        | 5          |
| 34  | Pot omogo   | *Manihot esculenta /Euphorbiaceae*              | 13        | 5.4        |
| 35  | Aquin       |                                                 | 1         | 0.4        |
| 36  | Oboke       |                                                 | 1         | 0.4        |
| 37  | Opwoo       |                                                 | 2         | 0.8        |
| 38  | Aconge      |                                                 | 3         | 1.3        |
| 39  | Ajanjala    |                                                 | 1         | 0.4        |
| 40  | Awin        |                                                 | 1         | 0.4        |
| 41  | Abita       |                                                 | 1         | 0.4        |
| 42  | Nakati      | *Solanum aethiopicum*                           | 5         | 2.1        |
| 43  | Odwang      |                                                 | 1         | 0.4        |
| 44  | Alebe       |                                                 | 1         | 0.4        |
| 45  | Icok        | *Ipomoea batatas*                               | 1         | 0.4        |

(15, 34)

**Cultivation Of Traditional Vegetables In Northern Uganda**

From our study, most of the common traditional vegetables were cultivated especially in the backyard but the less common ones were obtained from the wild (Fig. 2).

**Traditional Medicinal Vegetables In Northern Uganda**

A number of traditional vegetables in the current study were used for medicinal benefits as well. The detailed information regarding traditional medicinal vegetables is provided in Table 3.
| Vegetable (Local name/ Scientific name) | Diseases treated | Plant part used | Mode of Preparation, Administration and Amount |
|----------------------------------------|------------------|----------------|-----------------------------------------------|
| Amalakwang (*Hibiscus spp*)            | Poor appetite    | Leaves         | Stewed or Soup drunk; 2x a day or week        |
|                                        | Nausea           | Leaves         | Stewed without extracting soup 2xdaily       |
|                                        | Low saliva secretion | Leaves   | Stewed as above once a week                   |
|                                        | Low blood level  | Leaves         | Stewed (but not pasted for better results) once a day |
|                                        | Post-partum abdominal pain | Leaves   | Stewed once a day                            |
|                                        | Low Milk production during lactation | Leaves/ Seeds | Stewed 3x a day for 1 week after delivery while seeds are roasted, ground and eaten 3x a week |
|                                        | Vitamins         | Leaves         | Stewed daily                                 |
|                                        | Oral thrush      | Leaves         | Stewed 2x a week                             |
|                                        | Skin swellings   | Leaves         | Roasted and Rubbed on the affected part regularly until recovery |
|                                        | Wounds           | Leaves         | Roasted/heated and placed on the wound 2x daily until recovery |
|                                        | Ulcers           | Leaves/ seeds  | Leaves stewed 2–3 times a week lifelong while seeds are grounded and mixed with other foods regularly |
|                                        | Body swellings – esp. stomach swellings | Leaves   | Mixed with apuruk, boiled and soup drunk 2x a day |
|                                        | Poor vision      | Leaves         | Stewed 2x a day                              |
|                                        | Mouth sores with pus | Leaves   | Rough surface of raw leaves used to scrub sores until cleared |
|                                        | Cough            | Leaves / Roots | Leaves may be stewed or 3–4 raw leaves chewed 2x a day while 2–3 raw roots can also be chewed |
|                                        | Cold, flu        | Leaves         | Stewed as required                           |
| Vegetable (Local name/ Scientific name) | Diseases treated | Plant part used | Mode of Preparation, Administration and Amount |
|----------------------------------------|-----------------|-----------------|-----------------------------------------------|
| (stop) cannibalism                      | Leaves          | Boiled together with other herbs and eaten Once a day for 1 week |
| Toothache                               | Leaves          | Half boiled and placed on gum as required |
| Bone strength                           | Seeds           | Dried, fried, pounded and stewed mixed with other foods |
| Painful eyes                            | Leaves          | Crushed to obtain juice and dropped into the eye 2x daily |
| Poisoning                               | Leaves          | Boiled – without salt and eaten or soup drunk 3x a day until recovery |
| Akeo (Gynandropsis gynandra)            | Poor appetite   | Leaves          | Stewed 2x a week |
|                                        | Bloating        | Leaves          | Stewed once a week |
| Abdominal pain                          | Root/ Leaves + stem | Raw roots are chewed or pounded, juice extracted and drunk 3x daily for 3 days or Roasted, stewed and eaten at the time of pain while raw leaves are chewed or stewed 1-3x a day/ 3x a week; leaves also boiled, soup extracted and drunk 3x a day for 4 days |
| Ring worm + skin rashes                 | Leaves          | Crushed and applied(rubbed) on the affected area 2-3x a day for 1 week or until recovery |
| Improve sexual activity in men          | Leaves          | Stewed regularly |
| Headache (extreme)                      | Leaves          | Pound, tied in a cloth and wrapped around the head for 1 hour twice a day or cooked, soup drained and eaten 3x a week |
| Hypertension                            | Leaves          | Stewed for one month |
| Eye infection                           | Leaves          | Crushed to obtain juice which is applied to the eye once during infection or 2x a day for 3 days |
| Painful eyes                            | Leaves          | Rubbed and placed closer to the eyes for the vapor to enter, 3x a day |
| Otitis media                            | Roots           | Pounded, water added, and filtered and dropped in ear 2x a day |
| Removing blood clots from eyes          | Leaves + stem   | Stewed alone and eaten 3x a day |
| Vegetable (Local name/Scientific name) | Diseases treated | Plant part used | Mode of Preparation, Administration and Amount |
|--------------------------------------|-----------------|----------------|-----------------------------------------------|
| **Worm infestation (helminthes)**    | Leaves          | Crushed and the juice rubbed on affected area once a day for 2 weeks |
| **Visual impairment**                | Leaves / Roots  | Leaves stewed 3x a day/week while roots are pounded, juice extracted and drunk 3x a day |
| **Malaria**                          | Leaves          | Raw leaves chewed 3x a week or boiled, soup extracted and drunk 3x a day for 3 days |
| **Diabetes**                         | Leaves          | Stewed daily   |
| **Peptic ulcers**                    | Leaves          | Boiled, soup removed and eaten 3x a day |
| **Difficulty in delivery**           | Root            | Raw roots chewed once a day |
| **Prolonged labor**                  | Leaves          | Boil, juice extracted, mixed with tea leaves and drunk once |
| **Removal of placenta after delivery** | Leaves + stem + roots | Raw –Washed & crushed to obtain juice and drunk in small quantities frequently |
| **Postnatal abdominal pain**         | Leaves + Stem   | Stewed, pasted and eaten 3x a day |
| **Miscarriages**                     | Leaves          | Stewed regularly |
| **Sickle cell**                      | Leaves / Seeds  | Leaves stewed and mixed with Avocado while seeds are pounded, water added, juice removed and drunk (~ 150 ml) 3x a day |
| **Fever – in children**              | Leaves          | Crushed, mixed with water and the child bathed 3x a day |
| **Scorpion bite**                    | Leaves          | Cooked and soup removed and drunk for 3 days |
| **Toothache**                        | Roots           | Crushed to obtain juice which is applied to teeth 2x a day for 3days |
| **Otigo (Corchorus spp)**           | Leaves / Seeds  | Leaves stewed (alone for better results) and eaten regularly while seeds are stewed with other foods 2-3x a week lifelong and frequently for HIV patients |
|                                      | Leaves          | Stewed (+/- paste) regularly |
| Vegetable (Local name/Scientific name) | Diseases treated | Plant part used | Mode of Preparation, Administration and Amount |
|----------------------------------------|------------------|----------------|-----------------------------------------------|
| Prevent bone fracture in case of accident | Leaves | Stewed (+/-other foods) 2x a day |
| Joint lubrication & strength | Leaves | Stewed regularly |
| Heartburn | Leaves | Raw or stewed (but not pasted) 2x a day |
| Poor appetite | Leaves | Stewed, 1–2 a day/week |
| Ulcers | Leaves / Seeds | Leaves stewed 2x a day for 2 weeks while Seeds grounded and mixed with other foods/ also as tea 2x a day for 1 week |
| Purgation | Leaves/fruits | Stewed 2-3x a day |
| Flatulence | Leaves | Stewed regularly |
| Fasten fracture healing | Leaves | Cooked + silver fish |
| Muscle rigidity (contractures) | Leaves | Stewed 2x daily |
| Weak muscles | Leaves | Stewed 3x a day |
| Engorged blood vessels | Leaves | Stewed 3x daily |
| Constipation | Seeds | Cooked and eaten once after constipation or twice a week |
| Malnutrition | Leaves | Stewed and pasted, 2x a day |
| Scabies | Leaves | Dried, pounded, mixed with petroleum jelly and applied to the skin 2x a day |
| Anemia | Leaves | Stewed regularly |
| Rough voice (smoothening) | Leaves/seeds | Stewed 3x a day |
| Mental problems | Leaves | Stewed daily |
| Poisoning (antipoison) | Leaves | Stewed 2x a week |
| Vegetable (Local name/Scientific name) | Diseases treated | Plant part used | Mode of Preparation, Administration and Amount |
|---------------------------------------|------------------|----------------|-----------------------------------------------|
| Sickle cell disease                   | Leaves           | Stewed regularly |
| Vision                                | Leaves/seeds     | Stewed daily    |
| Hemorrhoids                           | Seeds            | Stewed regularly |
| Abdominal pain                        | Leaves           | Stewed as required |
| Enhance recovery from sickness        | Leaves           | Stewed alone    |
| Improve fetal health and ease birthing| Leaves           | Stewed alone    |
| Low immunity esp TB patients          | Fruit            | Stewed 2x a week |
| Painful swallowing, GI obstruction    | Leaves           | Stewed as required |
| Poor digestion                        | Leaves           | As above        |
| Alaju (Crotalaria ochroleuca)         | Anemia           | Leaves          | Stewed regularly                              |
|                                      | Malaria          | Leaves          | A hand full of Raw leaves chewed once a day or leaves are boiled (not pasted) and eaten or soup drunk (children) 2-3x a day for 2–4 days |
|                                      | Abdominal pain   | Leaves          | A half of a handful of raw leaves chewed 2x a day or leaves are boiled (+ salt only) 2-3x a day for 1-2days |
|                                      | Chest pain       | Leaves          | Stewed daily                                  |
|                                      | Body aches       | Leaves          | Stewed without paste daily                    |
|                                      | Visual impairment| Leaves          | Stewed daily                                  |
|                                      | Cough            | Leaves          | Raw leaves chewed 2x daily                    |
|                                      | Poor appetite    | Leaves          | Stewed 1-3x a day                             |
|                                      | Ulcers           | Leaves          | Stewed 2x daily                               |
|                                      | Heart burn       | Leaves          | Stewed regularly                              |
| Vegetable (Local name/Scientific name) | Diseases treated       | Plant part used | Mode of Preparation, Administration and Amount |
|---------------------------------------|------------------------|----------------|-----------------------------------------------|
|                                       | Fever                  | Leaves         | Stewed as required                            |
|                                       | Epilepsy               | Seeds          | Pounded and mixed with other herbs and drunk 2x a day for 3 days |
|                                       | Headache               | Leaves         | Stewed (+ salt only) 2x a day frequently      |
|                                       | HIV symptoms           | Leaves         | Stewed 3x a day, 2x a week life long          |
|                                       | Malnutrition           | Leaves         | Boiled, soup extracted and drunk 3x during childhood |
|                                       | Brucella               | Leaves         | Stewed until recovery                         |
|                                       | Eye infections-itching | Leaves         | Stewed 2-3x a day                             |
|                                       | Hypertension           | Leaves         | Raw leaves chewed or stewed daily             |
|                                       | Diabetes               | Leaves         | Raw leaves chewed or stewed daily             |
| Bojo (Vigna unguiculata)              | Anemia                 | Leaves         | Stewed regularly                              |
|                                       | Low vitamins           | Leaves         | Stewed 4x a day or raw leaves chewed 2x a day for 2 days or 2x a week |
|                                       | Poor appetite          | Leaves         | Raw/stewed 2x a week                          |
|                                       | Visual impairment      | Leaves         | Stewed 4x a week regularly                    |
|                                       | Immune boosting        | Leaves         | Stewed and pasted 2x a day                    |
|                                       | General body weakness  | Leaves         | As above                                      |
|                                       | (+ Otigo) malaria      | Leaves         | Stewed together 3x daily for 3 days          |
|                                       | Hernia                 | Leaves         | Stewed with Otigo regularly                   |
|                                       | Milk production (lactation) | Leaves         | Stewed at least 4x a day                     |
|                                       | Cancer ('Alooti')      | Leaves         | Raw leaves chewed regularly for 3months       |
|                                       | Improve sexual activity in men | Leaves         | Stewed                                       |
| Vegetable (Local name/Scientific name) | Diseases treated | Plant part used | Mode of Preparation, Administration and Amount |
|---------------------------------------|------------------|----------------|-----------------------------------------------|
|                                       |                  |                |                                               |
|                                       | Malaria          | Leaves         | Stewed 3x a day, 3x a week                    |
|                                       | Appendicitis     | Leaves         | Stewed                                        |
|                                       | Abdominal aches  | Leaves         | Raw leave eaten 3x a day for 2 days            |
|                                       | Ulcers           | Leaves         | Raw leaves chewed 2-3x a day or stewed once a day |
|                                       | Diabetes         | Leaves         | Mixed with acacia (Garcia), crushed to extract juice and drunk 2x a month stewed (+ paste) once daily or Raw leaves chopped and eaten daily |
| Cabbage (Brassica oleracea)           | Hemorroides      | Leaves         | 3–4 Raw leaves chewed once daily for 1 week    |
|                                       | Heart burn       | Leaves         | Stewed regularly                              |
|                                       | Cancer           | Leaves         | Stewed twice a day                            |
|                                       | Ulcers           | Leaves         | Half cooked + ground nuts 3x a daily          |
|                                       | (+ garlic)High blood pressure | Leaves | Raw leaves chewed frequently |
|                                       | Constipation     | Leaves         | Raw/ half cooked eaten 2x daily               |
|                                       | Drowsiness       | Leaves         | Raw/ half cooked eaten 2x daily               |
|                                       | Epilepsy         | Leaves         | Raw leaves eaten 3x a daily                   |
|                                       | Malaria          | Leaves         | Raw leaves eaten daily                        |
|                                       | Sore throat       | Leaves         | Stewed or raw, eaten 2x a day                 |
|                                       | Poor appetite     | Leaves         | Stewed                                        |
| Ocwica (Cucurbita maxima)             | Malaria          | Leaf/ seeds    | Leaves stewed while seeds are roasted, coat removed and eaten 3x daily for 3 days |
|                                       | Improves health during pregnancy | Leaves | Stewed and pasted regularly |
|                                       | Anemia           | Leaves         | Stewed daily                                  |
|                                       | Hepatitis B      | Leaves         | Stewed (+ salt + red pepper) 2x daily         |
|                                       | (+ cabbage) Coronary artery disease | Leaves | Raw leaves chewed 3X a day as required         |
| Vegetable (Local name/ Scientific name) | Diseases treated | Plant part used | Mode of Preparation, Administration and Amount |
|----------------------------------------|------------------|-----------------|-----------------------------------------------|
| Poor vision                            | Leaves           | Stewed, not pasted |
| Improve sexual activity in men (‘man power’) | Leaves / Seeds | Stewed or raw seeds chewed 2x a day |
| Appetizer                              | Leaves / seeds   | As above         |
| Poor vision                            | Leaves           | Stewed daily     |
| Improve sexual activity in men (‘man power’) | Seeds           | Uncoated and eaten raw frequently |
| Appetizer                              | Leaves / seeds   | As above         |
| Appetizer                              | Leaves           | As above         |
| High blood pressure                    | Seeds            | Stewed           |
| Wound healing                          | Leaves           | Stewed 2x a day |
| Urinary tract infections               | Leaves           | Stewed 2x a day |
| Memory enhancement                     | Fruits/ seeds    | Fruit- boiled; seeds – dried, fried, coat removed before eating |
| Ring worm                              | Leaves           | Crushed, juice extracted and applied to affected area 3x a day for 1 week |
| Abuga (Amaranthus spp)                 | Anemia           | Leaves / seeds   | Leaves stewed; seeds put in water, add sugar and ~ 300 ml drunk 1-2 x a day |
| Poor child growth                      | Leaves           | Stewed           |
| Poor appetite                          | Leaves           | Stewed 2x a week |
| Hepatitis B                            | Leaves           | Stewed 2x daily |
| Malnutrition                           | Leaves           | Stewed 2x a week |
| Awica (scientific name missing)        | Malaria (+ alaju) | Leaves          | Stewed “+salt only and eaten or soup drunk 2-3x a day for 4 days |
| Awica (scientific name missing)        | (+ otigo) Fasten healing | Leaves | Stewed |
| Awica (scientific name missing)        | Ulcers           | Stewed 2x daily |
| Awica (scientific name missing)        | Stomach aches    | Stewed 2x a day; twice a week or full plate 1-2x a day for 4 days or crushed raw to obtain juice and ~ 200 ml drunk 3x a day |
| Vegetable (Local name/Scientific name) | Diseases treated | Plant part used | Mode of Preparation, Administration and Amount |
|----------------------------------------|------------------|----------------|-----------------------------------------------|
|                                        | Poor appetite    | Leaves         | Stewed 2x a day                               |
|                                        | Anemia           | Leaves         | Stewed regularly                              |
|                                        | Visual impairment| Leaves         | Stewed (+ salt only) regularly                |
|                                        | Hypertension     | Leaves         | As above                                      |
|                                        | (+ Alaju) HIV symptoms | Leaves | Stewed (+ paste) regularly                 |
|                                        | Goiter           | Leaves         | Crushed, juice extracted and drunk 3x a day for 2 weeks |
|                                        | Worm infestation | Leaves         | Stewed (+ salt only) 2x a week                |
|                                        | Joint pain       | Leaves         | Stewed 2x a week                              |
| Opele (Colocasia esculenta)            | Appetizer        | Leaves         | stewed (+ raw simsim) regularly              |
|                                        | Pressure         | Leaves         | Stewed (+ paste) regularly                   |
| Pot kamalara (Capsicum spp. Red pepper)| Poor Vision      | Leaves /Fruit  | Leaves stewed regularly; Ripe fruit eaten daily |
|                                        | Stomach aches    | Leaves         | Stewed once a week                            |
|                                        | Hemorrhoids      | Leaves         | Stewed regularly                              |
| Ocuga (Solarium nigrum L)              | Stomach aches    | Leaves         | Stewed (+ salt only) 2x a day for 4 days or Raw leaves are crushed to obtain juice which is drunk (~ 250 ml) 3x a day |
|                                        | Peptic ulcers    | Leaves         | Stewed alone 2x a day                         |
|                                        | Skin infections  | “              | Stewed once daily                             |
|                                        | Visual problems  | Fruit / Leaves | Ripe fruit eaten once daily for 4 days while leaves are stewed 2x a day |
|                                        | Malaria          | Leaves         | Stewed once a day for 3 days                  |
|                                        | Eye infection    | Leaves / Fruits| Leaves stewed 2x a week lifelong while ripe fruits are eaten regularly |
|                                        | Weak bones       | Leaves         | Stewed 2x daily                               |
| Vegetable (Local name/Scientific name) | Diseases treated | Plant part used | Mode of Preparation, Administration and Amount |
|---------------------------------------|------------------|----------------|-----------------------------------------------|
| **Vegetable (Local name/Scientific name)** | **Diseases treated** | **Plant part used** | **Mode of Preparation, Administration and Amount** |
| **Immune boosting (prevent infections)** | Leaves | Stewed regularly |
| (+ Ayuu) malnutrition | Fruit/ Leaves | Ripe fruit eaten regularly while leaves are half cooked and eaten 3x a day until wellbeing |
| **Ayuu bap** (**Acalypha bipartite M**) | **Tooth decay** | Leaves | Raw leaves chewed 2x a day for 4 days |
| **Skin infections** | Leaves | Pounded, allowed to dry and mixed with petroleum jelly and applied to skin daily |
| **Leprosy** | Leaves | As above |
| **Stomach aches** | Leaves | Mixed with alaju and stewed 2x a day |
| **Diarrhea** | Leaves | Stewed and eaten once after diarrhea |
| **Constipation** | Leaves | Stewed once a week |
| **Facilitate growth in children** | Leaves | Stewed regularly |
| **Amola** | **Diarrhea – esp. in children** | Leaves | Roasted and ground to powder and eaten 3x a day |
| **Oyado** (**Cassia Obtusifolia L**) | **Diarrhea** | Leaves | Stewed (+ paste) 3x a day |
| **Headache** | Leaves | Stewed 3x a week |
| **Jagi** (**Solarium gilo L**) | **Stomach aches** | Fruits | Raw, eaten in small quantities |
| **Apuruk** (**Crassocephalum rubens**) | **Bad oral smell** | Leaves | Stewed, soup drained, and eaten once a week |
| **Weak bones** | Leaves | Stewed 2x daily |
| **Adipa-kong** | **Waist & back pain** | Leaves | Crushed and rubbed on affected part regularly for 1 month |
| **Bone weakness** | Leaves | Stewed 2x a day |
| **Aminotakara** | **Causes abortion** | Leaves | Crushed to obtain juice and ~ 500 ml drunk |
| **Nakati** (**Solanum aethiopicum**) | **Peptic ulcers** | Leaves | Stewed regularly |
| Vegetable (Local name/Scientific name) | Diseases treated | Plant part used | Mode of Preparation, Administration and Amount |
|---------------------------------------|------------------|-----------------|-----------------------------------------------|
| Heart burn                            | Leaves           | As above        |                                               |
| Ocwere                                | Diabetes         | Fruit           | Raw, chewed with salt, 2 fruits a day         |
|                                       | Blurred vision   | Fruit           | As above                                     |

**Vegetables Most Often Used For Traditional Medicinal Purposes**

A total of 15 vegetables were reported to be used commonly. Their extent of utility is represented in figure iii. The top 5 among the 15 were Otigo, Amalakwang, Alaju, Akeo and Bojo (Fig iii).

**Most Effective Medicinal Vegetable**

Reports on the most effective medicinal vegetable by the study participants are represented in figure iv. *Corchorus spp* was reported by most of the participants as most effective for its medicinal purposes.

**Informant Consensus Factor (ICF)**

Using the reports of the study participants, the ICF for the 15 most commonly used traditional medicinal vegetable was calculated. The least ICF value was found to be -7 while the highest was 1 (Table 4).
Table 4
ICF values for the diseases commonly treated by the traditional medicinal vegetables in Northern Uganda.

| Vegetable          | Condition               | No of participants report on condition (n) | Total No of species for condition (nt) | ICF = (n-nt)/(n-1) |
|--------------------|-------------------------|------------------------------------------|----------------------------------------|-------------------|
| Otigo (Corchorus spp) | Heartburn               | 2                                        | 5                                      | -3                |
|                    | Joint stiffness         | 67                                       | 1                                      | 1                 |
|                    | Constipation            | 14                                       | 4                                      | 0.77              |
|                    | Malnutrition            | 2                                        | 4                                      | -2                |
|                    | Anemia                  | 4                                        | 7                                      | -1                |
|                    | Poor appetite           | 26                                       | 9                                      | 0.68              |
|                    | Mental illness          | 1                                        | 1                                      | 0                 |
|                    | Purgation               | 6                                        | 1                                      | 1                 |
|                    | Joint pain              | 14                                       | 2                                      | 0.92              |
|                    | Difficulty swallowing   | 1                                        | 1                                      | 0                 |
|                    | Poor vision             | 1                                        | 9                                      | 0                 |
|                    | Ulcers                  | 6                                        | 6                                      | 0                 |
|                    | Headache                | 2                                        | 4                                      | -2                |
|                    | Engorged blood vessels  | 1                                        | 1                                      | 0                 |
|                    | Hemorrhoids             | 1                                        | 3                                      | 0                 |
|                    | Wounds                  | 1                                        | 3                                      | 0                 |
|                    | Bone pains              | 2                                        | 1                                      | 1                 |
|                    | Child birthing          | 2                                        | 3                                      | -1                |
|                    | Joint weakness          | 22                                       | 1                                      | 1                 |
|                    | Weak bones              | 7                                        | 2                                      | 0.83              |
|                    | Fracture prevention     | 3                                        | 1                                      | 1                 |
|                    | Malaria                 | 1                                        | 8                                      | 0                 |
| Amalakwang         | Poor appetizer          | 74                                       | 10                                     | 0.88              |
|                    | Wounds                  | 1                                        | 2                                      | 0                 |
|                    | Cough                   | 5                                        | 2                                      | 0.75              |
| Vegetable          | Condition               | No of participants report on condition (n) | Total No of species for condition (nt) | ICF= (n-nt)/(n-1) |
|--------------------|-------------------------|-------------------------------------------|----------------------------------------|------------------|
| Poison antidote   | 2                       | 2                                         |                                        | 0                |
| Malaria            | 4                       | 8                                         |                                        | -1.33            |
| Bone weakness      | 3                       | 2                                         |                                        | 0.5              |
| Waist pain         | 2                       | 3                                         |                                        | -1               |
| Paralysis          | 1                       | 1                                         |                                        | 0                |
| Sickle cell        | 2                       | 2                                         |                                        | 0                |
| Poor lactation     | 26                      | 1                                         |                                        | 1                |
| Anemia             | 4                       | 7                                         |                                        | -1               |
| Poor vision        | 4                       | 9                                         |                                        | -2               |
| Postpartum abdominal pain | 1 | 1                    |                                        | 0                |
| Ulcers             | 5                       | 6                                         |                                        | -0.25            |
| Abdominal swellings | 3                    | 1                                         |                                        | 1                |
| Alcohol reaction   | 2                       | 1                                         |                                        | 1                |
| Alaju (Crotalaria ochroleuca) | | | | |
| Malaria            | 76                      | 8                                         |                                        | 0.91             |
| Headache           | 2                       | 4                                         |                                        | -2               |
| Bloating           | 2                       | 1                                         |                                        | 1                |
| Joint pain         | 1                       | 2                                         |                                        | 0                |
| Poor appetite      | 3                       | 10                                        |                                        | -3.5             |
| Anemia             | 2                       | 7                                         |                                        | -5               |
| Body aches         | 7                       | 2                                         |                                        | 0.83             |
| Improve health     | 5                       | 2                                         |                                        | 0.75             |
| Poor vision        | 6                       | 9                                         |                                        | -0.6             |
| Abdominal pain     | 16                      | 8                                         |                                        | 0.53             |
| High blood pressure | 3                      | 6                                         |                                        | -1.5             |
| Ulcers             | 9                       | 6                                         |                                        | 0.38             |
| Akeo               | Malaria                 | 12                                        | 8                                       | 0.36             |
| Vegetable | Condition                  | No of participants report on condition (n) | Total No of species for condition (nt) | ICF= (n-nt)/(n-1) |
|-----------|----------------------------|--------------------------------------------|----------------------------------------|-------------------|
|           | Poor vision                | 10                                         | 9                                      | 0.1               |
|           | Difficulty in parturition  | 2                                          | 2                                      | 0                 |
|           | Headache                   | 8                                          | 4                                      | 0.57              |
|           | Sickle cell dse            | 1                                          | 2                                      | 0                 |
|           | Constipation                | 1                                          | 4                                      | 0                 |
|           | Man power                  | 1                                          | 3                                      | 0                 |
|           | Skin rash                  | 1                                          | 2                                      | 0                 |
|           | Poor appetite               | 11                                         | 10                                     | 0.1               |
|           | Ring worm                  | 21                                         | 2                                      | 0.95              |
|           | Abdominal pain             | 34                                         | 8                                      | 0.79              |
|           | Poor health                | 2                                          | 3                                      | -1                |
|           | High blood pressure        | 1                                          | 6                                      | 0                 |
|           | Eye/ear infection          | 4                                          | 3                                      | 0.33              |
|           | Worm infestation (helminthes) | 3                                       | 2                                      | 0.5               |
| Bojo      | Wounds                     | 2                                          | 3                                      | -1                |
|           | Headache                   | 1                                          | 4                                      | 0                 |
|           | Poor appetite               | 14                                         | 10                                     | 0.31              |
|           | Poor vision                | 12                                         | 9                                      | 0.27              |
|           | Anemia                     | 3                                          | 7                                      | -2                |
|           | Immune boosting            | 9                                          | 4                                      | 0.63              |
|           | Malaria                    | 10                                         | 8                                      | 0.22              |
|           | Hemorrhoids                | 2                                          | 3                                      | -1                |
|           | Diabetes                   | 4                                          | 4                                      | 0                 |
|           | Ulcers                     | 7                                          | 6                                      | 0.17              |
| Acwica    | Pregnancy                  | 2                                          | 3                                      | -1                |
|           | High blood pressure        | 1                                          | 6                                      | 0                 |
| Vegetable | Condition                                      | No of participants report on condition (n) | Total No of species for condition (nt) | ICF= (n-nt)/(n-1) |
|-----------|------------------------------------------------|------------------------------------------|----------------------------------------|------------------|
|           | Memory                                         | 1                                        | 1                                      | 0                |
|           | Hang over                                      | 2                                        | 1                                      | 1                |
|           | Male sexual enhancement (man power)            | 1                                        | 3                                      | 0                |
|           | Yellow fever                                   | 1                                        | 1                                      | 0                |
|           | Promotion of Labor                             | 1                                        | 3                                      | 0                |
|           | Malaria                                        | 16                                       | 8                                      | 0.53             |
|           | Anemia                                         | 4                                        | 7                                      | -1               |
|           | Poor appetite                                  | 11                                       | 10                                     | 0.1              |
|           | Poor vision                                    | 2                                        | 9                                      | -7               |
|           | Poor health                                    | 6                                        | 3                                      | 0.6              |
|           | Ringworm                                       | 1                                        | 2                                      | 0                |
|           | Hepatitis B                                    | 3                                        | 2                                      | 0.5              |
|           | Abdominal pain                                 | 4                                        | 8                                      | -1.33            |
| Abuga     | Anemia                                         | 29                                       | 7                                      | 0.79             |
|           | Appetite                                       | 7                                        | 10                                     | -0.5             |
|           | Hepatitis B                                    | 1                                        | 2                                      | 0                |
|           | Abdominal pain                                 | 1                                        | 8                                      | 0                |
|           | Malaria                                        | 1                                        | 8                                      | 0                |
| Cabbage   | Hemorrhoids                                    | 4                                        | 3                                      | 0.33             |
|           | Hemorrhage                                     | 1                                        | 1                                      | 0                |
|           | Immune boosting                                | 1                                        | 4                                      | 0                |
|           | Heart burn                                     | 5                                        | 3                                      | 0.5              |
|           | Ulcers                                         | 26                                       | 6                                      | 0.8              |
|           | Coronary artery disease                        | 1                                        | 1                                      | 0                |
|           | High blood pressure                            | 5                                        | 6                                      | 0.25             |
| Vegetable | Condition | No of participants report on condition (n) | Total No of species for condition (nt) | ICF= (n-nt)/(n-1) |
|-----------|-----------|----------------------------------------|-------------------------------------|------------------|
| Poor appetite | 3 | 10 | -3.5 |
| Cancer | 5 | 1 | 1 |
| Constipation | 3 | 4 | -0.5 |
| Goiter | 1 | 1 | 0 |

**Fidelity Level (FL)**

The FL for the traditional medicinal vegetables which treated diseases with ICF values 0.5 and above was also calculated. According to our findings, the fidelity level values ranged from 1.08 to 60.42% (Table 5).
| Vegetable     | Condition                  | No of participants report on condition (Ip) | Total No of reports for any use (Iu) | FL = (Ip/Iu)*100 |
|---------------|----------------------------|---------------------------------------------|--------------------------------------|------------------|
| Otigo (Corchorus spp) | Joint pain and stiffness | 81                                          | 185                                  | 43.78            |
|               | Constipation               | 14                                          | 185                                  | 7.57             |
|               | Poor appetite              | 26                                          | 185                                  | 14.05            |
|               | Purgation                  | 6                                           | 185                                  | 3.24             |
|               | Bone pains                 | 2                                           | 185                                  | 1.08             |
|               | Joint weakness             | 22                                          | 185                                  | 11.89            |
|               | Weak bones                 | 7                                           | 185                                  | 3.78             |
|               | Fracture prevention        | 3                                           | 185                                  | 1.62             |
| Amalakwang    | Poor appetite              | 74                                          | 143                                  | 51.75            |
|               | Cough                      | 5                                           | 143                                  | 3.50             |
|               | Bone weakness              | 3                                           | 143                                  | 2.1              |
|               | Poor lactation             | 26                                          | 143                                  | 18.18            |
|               | Abdominal swellings        | 3                                           | 143                                  | 2.1              |
|               | Alcohol reaction           | 2                                           | 143                                  | 1.4              |
| Alaju         | Malaria                    | 76                                          | 132                                  | 57.58            |
|               | Bloating                   | 2                                           | 132                                  | 1.52             |
|               | Body aches                 | 7                                           | 132                                  | 5.30             |
|               | Poor health                | 5                                           | 132                                  | 3.79             |
|               | Abdominal pain             | 16                                          | 132                                  | 12.12            |
| Akeo          | Difficulty in parturition  | 2                                           | 113                                  | 1.77             |
|               | Headache                   | 8                                           | 113                                  | 7.08             |
|               | Ring worm                  | 21                                          | 113                                  | 18.58            |
|               | Abdominal pain             | 34                                          | 113                                  | 30.09            |
|               | Worm infestation (helminthes) | 3                                      | 113                                  | 2.65             |
| Vegetable | Condition     | No of participants report on condition (Ip) | Total No of reports for any use (Lu) | FL = (Ip/Lu)*100 |
|-----------|---------------|---------------------------------------------|--------------------------------------|------------------|
| Bojo      | Immune boosting | 9                                           | 82                                   | 10.98            |
| Acwica    | Hang over     | 2                                           | 56                                   | 3.57             |
|           | Malaria       | 16                                          | 56                                   | 28.57            |
|           | Poor health   | 6                                           | 56                                   | 10.7             |
|           | Hepatitis B   | 3                                           | 56                                   | 5.36             |
| Abuga     | Anemia        | 29                                          | 48                                   | 60.42            |
| Cabbage   | Hemorrhoids   | 4                                           | 56                                   | 7.14             |
|           | Heart burn    | 5                                           | 56                                   | 8.9              |
|           | Ulcers        | 26                                          | 56                                   | 46.43            |
|           | Cancer        | 5                                           | 56                                   | 8.93             |
| Awica     | Malaria       | 13                                          | 29                                   | 44.8             |

**Diseases Treated Per Body Systems**

The traditional vegetables were used to treat diseases associated with diverse body systems. Examples include: the digestive system, the reproductive system and the cardiovascular system (Tables 6)
Table 6
Diseases treated by traditional vegetables in Northern Uganda per body system

| System               | Diseases treated                                                                 | Traditional vegetables used                                      |
|----------------------|----------------------------------------------------------------------------------|---------------------------------------------------------------|
| Digestive system     | Poor appetite, nausea, low saliva production, oral thrush, peptic ulcers, abdominal pain, bloating, flatulence, purgation, heart burn, diarrhea, bad oral smell, constipation, hemorrhoids, sore throat, hernia | Amalakwang, Apuruk, Jagi, Oyado, Nakati, Ámola, Ayuu, Ocuga, Kamalara, Opele, Awica, Abuga, ocwica, cabbage, Bojo, Alaju, Otigo, Akeo |
| Reproductive system  | Postpartum abdominal pain, poor lactation, sexual difficulties, prolonged labor, placenta removal, pregnancy, miscarriages, | Ocwica, Bojo, Otigo, Akeo, |
| Endocrine            | Diabetes, goiter                                                                  | Ocwere, Awica, Bojo, Alaju, Akeo, |
| Musculoskeletal      | Waist and backaches, joint pain and stiffness, joint weakness, bone fractures, muscle rigidity, tooth decay, | Otigo, Adipa-ikong, Otigo, Apuruk, Ayuu, Ocuga, Awica, Bojo, Alaju, Amalakwang |
| Respiratory          | Cough, flu/cold                                                                   | Alaju, Amalakwang |
| Renal                | Urinary tract infections,                                                         | Ocwica, |
| Cardiovascular       | Hypertension, anemia, headache, coronary artery disease, blood vessel engorgement, blood clotting, | Kamalara, Awica, Abuga, Ocwica, Alaju, Cabbage, Bojo, Otigo, Akeo |
| Nervous              | Poor vision, mental illnesses, memory enhancement, drowsiness, epilepsy,          | Ocwere, Ocuga, Kamalara, Awica, Ocwica, Cabbage, Bojo, Alaju, Otigo, Akeo, Amalakwang |
| Integumentary        | Skin rashes and infections, leprosy, ring worm, scabies, wounds                  | Ayuu, Ocwica, Akeo, Otigo, Amalakwang |
| Others               | Malnutrition, growth retardation, eye/ear infections, immune boosting, malaria, helminth infestation, HIV symptoms, Hepatitis B, wound healing, hang over, cancer, Brucella, fever, sickle cell disease, Poisoning, rough voice, scorpion bite | Ayuu, Ocuga, Awica, Akeo, Abuga, Ocwica, Otigo, Cabbage, Bojo, Alaju, Otigo, Amalakwang |

Source Of Information

According to our findings, the study participants obtained information regarding traditional medicinal uses of the vegetables from 1)- Parents/ guardians (166); 2)- Friends (55); 3)- Relatives (33); 4)- Radio (38) and 5)- Neighbor 17). Other sources included experience (32), health worker (19), sensitization (5), church (2) and market (7).
Selected Key Informant Reports

Common medicinal vegetables: usage

A 55 year old female herbalist

“The leaves of Otigo are used for low appetite. You can boil alone or mixed with other vegetables and serve in a juice form. Children, 1 teaspoon three times a day. Over 5 years, 1 table spoon. For adults, you increase the amount. The leaves of Otigo can also be used for difficulty in breathing. Mix with other vegetables but if chopped and put in water it is effective. For the roots, get the root, wash, pound and apply to the joints for joint pain. The roots are curative for hemorrhoids... The roots of Akeo are used to accelerate labor and to deliver stacked placenta. It is boiled and taken when hot. The flowers are used in treatment of allergy. Squeeze and apply drops into the nose”.

A 73 year old male herbalist

“Alaju plus abuga to treat malaria; pound and squeeze juice after boiling. Give about a spoonful 3 times a day. The juice can stay for 1 week. Epilepsy mix icuru roots pounded plus apena kulu roots plus itutu roots with yellow owers then pound. Icuru is very strong so pick small amount and mix and boil. Filter to extract juice. Give half a glass 3 times a day. Give every time the moon is appearing since epilepsy is seasonal. Follow the trends until epilepsy is eliminated”.

Discussion

Not only are traditional vegetables useful as food sources, they also provide a wide range of medicinal values. In our study, the participants were required to mention the vegetable, conditions treated, parts used, modes of preparation and administrations and amount. A total of 45 traditional vegetables were documented in our study (Table 2). Out of the 45, fifteen were used as traditional medicines (Table 3). The most mentioned were *Corchorus spp*, *Hibiscus spp*, *Gynandropsis gynandra* and *Crotalaria ochroleuca* and *Corchorus spp*. was reported most effective (Figure iii and iv.). They were used for treating conditions which ranged from gastrointestinal complications such as abdominal pains and oral thrush through reproductive abnormalities like difficulty birthing and male sexual complications to musculoskeletal disturbances such as joint pain and stiffness (Table 3). Meanwhile the most commonly used parts included leaves which were stewed for their medicinal applications and there was no specific dosage for most of the conditions treated (Table 3). Some of the vegetables were administered a number of times per day while others per week or as required (Table 3). The most used traditional medicinal vegetables were often cultivated especially in the backyard (figure ii.). Most of the participants obtained information regarding the medicinal uses of the traditional vegetables from their parent or guardians.

Some of the traditional vegetables documented in the current study relate to earlier findings (15) but many of them are not revealed. The medicinal uses of the commonly used traditional vegetables in the current study relate to other findings as indicated below:
Amalakwang (*Hybiscus spp*) was used for Poor appetite, Nausea, Low saliva secretion, Low blood level, Post-partum abdominal pain, Low Milk production during lactation, Vitamins, Oral thrush, Skin swellings, Wounds, Ulcers, Body swellings – esp. stomach swellings, Poor vision, Mouth sores with pus, Cough, Cold, flu, to stop cannibalism, Toothache, Bone strength, Painful eyes and Poisoning. These findings agree with those of Qi and Aziz (35, 36) in which the plant was found to treat sores and wounds; along with the findings of Mahadevan and Kamali (37, 38) where the plant was found to be useful as an antihelminth, antibacterial and for cough. In addition, Okasha (39) found the plant to be lactogenic which also agrees with the findings of the current study.

Akeo (*Gynandropsis gynandra*) was used in the management of poor appetite, abdominal pain, scorpion bite, ringworm, difficult/prolonged labor, removal of retained placenta, postpartum bleeding, extreme headache, worm infestation, eye/ear infections including removal of blood clots among others. These findings could be explained by the antimicrobial activity of the plant as reported by Ajayiyoeba and Amanirampa (40, 41) where the plant was reported to exhibit antibacterial and antifungal activity. In addition, Scippers and Kamatenesi (42, 43) found the plant useful in migraine headaches, ear infections and abdominal pains coupled to acceleration of labor and reduction of postpartum haemorrhage which as well is in line with the findings of the current study.

Otigo (*Corchorus spp*) was found to strengthen weak joints coupled to improving joint flexibility. It was also found to strengthen bones and thus prevent fracture formation as well enhance fracture healing. This could be attributed to the fact that the plant is rich in calcium as reported by Idris (44) which favors mineralization thus strengthening the bones or due to the antioxidant activity of *C. olitorius* which activates differentiation of osteoblasts, enhance bone mineralization and reduce osteoclast activity (45, 46). In Zimbabwe, the plant is used for backaches (47) which is in agreement with the finding of the current study since the study participants reported using the plant for body aches. However, most of the findings of the current study about *Corchorus spp* are contrary to its uses in other places like Benin where the plant is used for cardiac insufficiency, fever, malaria, female fertility, ulcerations and gastrointestinal problems (48). This could be due to failure to recognize the effects of *C. Olitorius* in these conditions by Ugandans. The plant is reported to be useful as an anti-ulcer; laxative/purgative in the current study probably due to its richness in fiber (49) and its gastro-protective effects (50, 51).

Alaju (*Crotalaria ochroleuca*) was found by the current study to treat malaria, abdominal pain, ulcers, epilepsy, chest pain, body aches, hypertension, diabetes among others (see Table 2). These findings agree with those of Anywar and Ashuraduzzaman (34, 52) where the plant was found to treat malaria and relieve bronchospasms which could be attributed to the chest pain in the current study. In a study conducted in Nigeria, the plant was found to have antibacterial and antifungal activity(53). This could explain its use for abdominal pains, brucella, cough and fever in the current study.

Boyo (*Vigna unguiculata*) was reported to alleviate poor appetite, abdominal pains, ulcers, visual impairment among other uses in the current study. In a study conducted by Kritzinger and friends, the plant was found to have antimicrobial activity (54) alongside the findings of Gupta (55). These findings
supports the use of the plant for abdominal pains in the current study. In addition, this is a green leafy vegetable rich in vitamin A which is well known for improving sight (56).

Cabbage (Brassica oleracea) was used for ulcers, hypertension, malaria, constipation, epilepsy and sore throat. This could be partly explained by the fact that the plant is bioactive (57) and that it possesses antihyperglycaemic properties (58).

Ocwica (Cucurbita maxima) was found to improve male sexual activity and fetal health, enhance wound healing, enhance memory and treat hepatitis B and coronary artery disease in the present study. On the contrary, a study by Dubey showed that the plant was used as a remedy for tape worms, as a sedative, a tonic, a diuretic, has anticancer, antidiabetic and hepato-protective activity(59). The plant was found by Solomon and others to have antimicrobial activity(60). This finding justifies the wound healing effect in the current study.

The most frequent plant part used in the current study was the leaves. This was in agreement with other related studies (13, 61, 62).

The informant consensus factor (ICF) for the most commonly used traditional medicinal vegetables ranged from −3 to 1 (Table 4). A variety of vegetables were used for the different ailments which greatly reduced the ICF. For conditions where only a few vegetables were used for management, the resultant ICF was higher. The vegetable and conditions with the highest ICF were Otigo for joint stiffness, joint weakness and pain (ICF = 1); Amalakwang for poor lactation; Alaju for malaria and body aches (ICF > 0.83); Akeo for ringworm and abdominal pain (ICF > 0.75). On the other hand, the fidelity levels (FL) where highest for Abuga (Anemia, 60.4%), Alaju (malaria, 57.6%), Amalakwang (poor appetite, 51.8%), Awica (malaria, 44.8%) and Otigo (joint pain and stiffness, 43.8%) (Table 5). Amaranthus spp is reported to boost blood levels (alleviate anemia) (63); Alaju is reported by Anywar to be an antimalarial agent (34). Hibiscus spp is also reported to be lactogenic (39, 64). These reports support the findings of this study.

**List Of Abbreviations**

ICF: Informant consensus factor, FL: Fidelity level

**Declarations**

**Ethics approval and consent to participate**

The study was approved by the IRB of Mbarara University of Science and Technology

**Consent for publication**

Not applicable

**Availability of data and material**
The datasets generated and/or analysed during the current study may be obtained from the corresponding author upon request.

**Competing interests**

The authors declare that there are no competing interests

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**Authors’ contributions**

NR: Conception of idea, methods, data collection and first manuscript draft; SBA and MKA: research design, data collection and manuscript review; JOK and PA: general oversight and manuscript review

All authors read and approved the final manuscript

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Figures

Figure 1

https://reliefweb.int/map/uganda/northern-uganda-sub-regions 11/08/2020
Figure 2

Cultivated vegetables in Northern Uganda

Figure 3

Vegetable Most often used for medicinal purposes
Figure 4

Most effective medicinal vegetable