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Knowledge and practices of traditional treatment of chicken diseases using medicinal plants by indigenous communities in Najjembe sub-county, Buikwe district central Uganda

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Abstract

Background For centuries, farmers in central Uganda have used diverse medicinal plants in ethnoveterinary medicine for treating chicken diseases. However, the unique plant species used, and associated ethnoveterinary knowledge had not been well documented. Hence this research reports the medicinal plants used in the management of chicken diseases in Najjembe sub-county, Buikwe District, Central Uganda to guide the advancement and sustainable use of these plants in the future.

Methods An ethnoveterinary survey was conducted among 150 chicken farmers who were purposively sampled from ten villages within Najjembe sub-county, Buikwe district from January to September 2021. Voucher specimens of the plants were prepared, identified and authenticated at Makerere University Herbarium. Numerical data summarized using percentages, frequencies, Informant Consensus factor (ICF) and paired comparisons.

Results All farmers (150), at least used medicinal plants to treat chicken diseases, with majority of them aged 25 to 44 years (65.3%) and acquired this indigenous knowledge from family members (48%). Fifty-nine plant species were reported with the most cited or preferred being; *Aloe vera* (L.) Burm.f., (64), *Capsicum frutescens* L., (60), *Nicotiana tabacum* L. (55), *Cannabis sativa* L. (50), *Bidens pilosa* L. (12), *Momordica foetida* Schumach. (10). The plants belonged to 59 genera and 31 families: mostly Asteraceae (n=8, 13.6%), Fabaceae (n=5, 8.5%), Rosaceae (n=5, 8.5%), Myrtaceae (n=4, 6.8%) and Lamiaceae (n=4, 6.8%). Most medicinal plants were herbs (45.8%) and trees (25.4%). Leaves (66.1%) were the most used parts and were largely prepared as decoctions (38.9%). Most plant species had ICF greater than 0.7 for given chicken disease implying a high consensus in the community. *Nicotiana tabacum* L. had ICF values of 0.98, 0.98, 0.90, 0.98, 0.86 and 0.88 for swollen eyes, manson's eye worm, eye infections, diarrhea, fowl typhoid and flue. The major challenges reported were failure to determine doses and scarcity of medicinal plants due to the escalating deforestation of Mabira Central Forest Reserve.

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Conclusion There is widespread use of herbal medicines in the treatment of several chicken ailments in Najjembe sub-county, Buikwe District. The rich diversity of medicinal plants provides good prospects for development of novel ethnopoultry drugs that might provide a solution to the escalating global resistance against conventional chicken drugs. Although some of the species are exotic in Uganda, there is an urgent need to conserve the threatened plant species against increasing deforestation, climate change, human settlement and agricultural expansion.

Keywords Ethnobotany, Ethnoveterinary, Medicinal plants, Poultry, One health

Background

Agriculture is a dominant sector in Uganda's economy and in the financial year 2021/2022 agriculture accounted for about 24.1% of gross domestic product and contributed 33% of export earnings [1, 2]. Additionally, 70% of Uganda's working population is employed in agriculture [2]. Livestock farming which includes chicken is a major economic activity in Uganda contributing to about 4% of the country's gross domestic product [1]. In Uganda, chicken farming business is one of the profitable businesses with relatively low investment and high returns. Chicken farming provides significant employment and livelihood to citizens both in urban and rural settings. Furthermore, in Uganda, chicken have a lot of cultural and social value attached to them. For example, chickens are offered during traditional marriage ceremonies as both gifts and food, and they are used in cultural rituals during exorcism or as sacrifices to gods [3, 4]. There were an estimated 43.1 million chickens in Uganda in 2020 in comparison to 23.5 million in 2002, and about 2.6 million households (40%) have one or more chickens [5]. Although the free-range indigenous breeds of chicken are still very common (80%) in rural settings, the majority of the breeds in urban settings are exotic [6]. With the population of Uganda projected to increase from 45 million in 2020 to 100 million in 2050, the demand for poultry products will ultimately increase leading to intensive chicken rearing [1].

Despite the significance of poultry farming and its great contribution to the majority of the Ugandan population, the industry still faces major challenges [7]. These challenges include; increased use of antibiotics resulting in increased antibiotic resistance, emergence of new poultry diseases, improper knowledge of balanced feeding, and not actively meeting the requirements of protein and nutrition [7]. With the aforementioned challenges, there is a need to explore phytochemicals as novel sources of medicine as well as contributing sufficiently to the nutritional requirements of chicken. Most importantly phytochemicals are embedded in indigenous knowledge healing systems which increases their acceptability among chicken farmers [8]. Therefore, despite the existence of allopathic veterinary medicines, farmers particularly in rural settings still use ethnoveterinary medicinal plants (EVM) for the prevention and treatment of chicken diseases as the primary option [9–12].

The knowledge and practices of EVM are transferred from generation to generation verbally and are usually held as a secret among chicken owners [11, 12]. Whereas there is extensive documentation of the knowledge, practices, and safety with regard to plant species used against human diseases [13–21], documentation of ethnoveterinary medicinal plants' knowledge and practices is far from completion worldwide. In Uganda, few studies have documented EVM related to cattle and there is a paucity of data with regards to chicken. For example some studies have documented certain medicinal plants to be used in management of chicken diseases in Eastern and Northern Uganda [10]. However, there is significant difference in the medicinal plant diversity between Central Uganda and the previously studied regions as they lie in different floristic regions [22]. Additionally, the treatment practices of the regions significantly differ due to their different cultures, indigenous knowledge and socioeconomic statuses. It was therefore highly likely that Buikwe district in central Uganda has unique medicinal plant species and indigenous practices that have never been documented previously. This study was therefore undertaken to document this unique indigenous knowledge and practices for preservation and use by the future generation, conservation purposes, establish relationships in the use of herbal medicines between chicken and humans as well as support the discovery and development of new medicines for chicken diseases.

Materials and methods

Study design

This was a cross-sectional study conducted from January 2021 to September 2021.

Study area description

This ethnobotanical survey was conducted in Najjembe sub-county, Buikwe District Central Uganda. This area houses the biggest part of Mabira Central Forest Reserve which is one of the major natural forests in Uganda (Fig. 1). The Mabira Central Forest Reserve is a source for many traditional medicinal plant species in central Uganda. Buikwe District is bordered by Kayunga District to the north, Jinja District to the east, Buvuma District to the southeast, the Republic of Tanzania to the south, and Mukono District to the west. Najjembe sub-county has 8,165 households and houses a population of 33,410

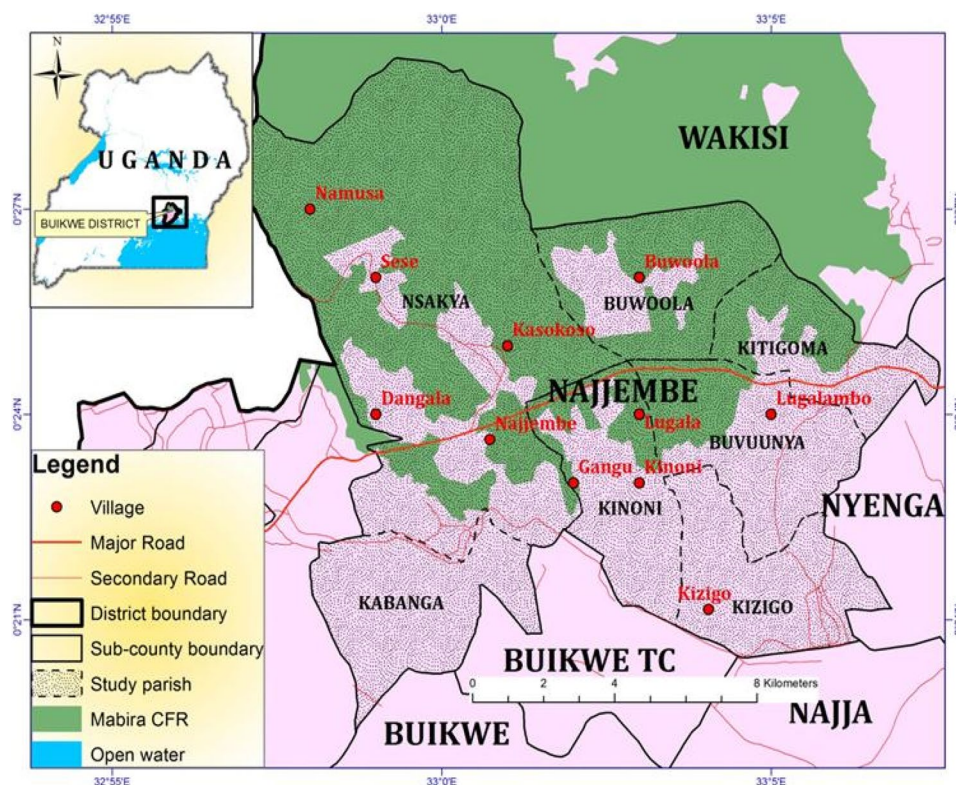


Fig. 1 Map of study location showing Najjembe sub-county in Buikwe district

people of which 50.3% are male [1, 2]. The majority of the people (66.5%) in Buikwe district live in rural areas [1]. The economic activities in the district include subsistence agriculture and growing of sugarcane. Residents who depend on subsistence farming majority cannot afford allopathic veterinary medicines but instead use ethnoveterinary medicinal plants (EVM) to treat diseased chicken. The district has eight sub-counties namely: Nyenga, Najjembe, Ssi Bukunja, Naja, Ngogwe, Buikwe, Kawolo, and Wakisi, and two town councils, namely Njeru and Lugazi [23]. The district has a tropical rainforest climate and therefore no distinct seasons over the year.

Sample size and sampling procedures

Five parishes namely Nsakyia, Kabanga, Kinoni, Buwoola, and Buvunya were randomly selected in Najjembe sub-county and eventually, two villages were considered from each parish, giving a total of 10 villages. Considering the population of chicken farmers in Nsakyia, Kabanga, Kinoni, Buwoola, and Buvunya parishes of 250, a sample size of 150 poultry farmers was calculated using the formula suggested by Krejcie and Morgan [24]. These respondents were both females and males aged 18 years and above. Among the chicken farmers, the respondents were purposively sampled to participate in the study depending on their ability and reputation to prepare herbal remedies for management of chicken diseases.

In each village, respondents were identified using the snowballing method. Once the farmer was identified and interviewed, they were asked to refer the research team to another reputable chicken farmer within their networks who prepares herbal medicine for chicken diseases. The subsequent farmer then referred us to the next farmer in their networks until saturation was reached. From each village, 10–15 respondents were interviewed altogether. All respondents first signed consent forms before participating in the study and each respondent was compensated for the time spent participating in the study.

Ethnobotanical data collection

Data were collected using a semi-structured questionnaire (Supplementary file1) following guidelines for conducting research during the COVID-19 pandemic established by the Uganda National Council of Science and Technology [25]. A pilot study was conducted in January 2021 to pre-test the study tool, sensitize the local area administration and seek their permission. Data was collected with the help of research assistants (translators) who were familiar with the local language (Luganda). The questionnaire included questions on the TMP bio-data, signs and symptoms of chicken diseases, names of medicinal plants used and plant parts, preparation procedure, route of administration, packaging and dosage of ethnopoultry medicines. Questions on the treatment

options, sources of the medicinal plants and challenges were also included. Five focus group discussions were held with community members to complement the questionnaire surveys particularly on issues of disease recognition, medicine packaging, administration and threats to medicinal plants. Pairwise ranking was done to get the species that were considered to be most efficacious by the farmers. Voucher specimens of the plant species used were collected and taken to the Makerere University Herbarium for identification. Species nomenclature followed the flora for tropical East Africa and was verified using the Plants of the World Online (POWO) database (<https://powo.science.kew.org>).

Data analysis

The data were entered into Microsoft Excel, coded, and exported to SPSS software (version 26, SPSS Inc.) for

Table 1 Socio-demographic characteristics of respondents from Najjembe sub-county, Buikwe district

Characteristic	Frequency	Percentage (%)
Age		
15–24	13	8.7
25–44	98	65.3
45–64	30	20.0
≥ 65	9	6.0
Sex		
Female	92	61.3
Male	58	38.7
Education		
None	30	20.0
Primary	82	54.7
Secondary O'level	32	21.3
Secondary A'level	3	2.0
Tertiary	3	2.0
Religion		
Anglican	33	22.0
Islam	37	24.7
Pentecostal	13	8.7
Catholic	64	42.7
SDA	1	0.7
Others	2	1.3
Marital status		
Divorced	8	5.3
Married	95	63.3
Separated	9	6.0
Single	26	17.3
Widowed	12	8.0
Occupation		
Boda boda rider	8	5.3
Business person	34	22.7
Farmer	84	56.0
Herbalist	1	0.7
Teacher	1	0.7
Unemployed	22	14.7

analysis. Descriptive statistics such as percentages and frequencies were used to summarize the data. The informant consensus (ICF) factor was calculated to determine the homogeneity of the ethnoveterinary medicinal plants information collected from the respondents using equation 1 [26]:

$$\text{Equation 1: } ICF = \frac{N_{ur} - N_t}{N_{ur} - 1}$$

where “Nur” refers to the total number of use reports (URs) for each disease cluster and “Nt” refers to the total number of species in each use category. The ICF values range from 0 to 1. High ICF values (close to 1) are obtained when only a few plant species are reported to be used by a high proportion of informants to treat a particular disease and this implies that there is a well-defined mechanism in the community of sharing information between informants. When a variety of plant species are utilized to treat the same health problem, individuals prefer one over the other. Therefore, preference ranking was performed to determine which species were preferred over others as described in Martin [27]. Key informants were tasked to compare the given chicken treatments based on their values. The most preferred plant species were ranked highest on a scale of 1–5, 5 being the most preferred and 1 being the least preferred. A paired comparison was made for five medicinal plants used to treat chicken diseases in the study area. Following the focus groups, farmers were requested to rank the species based on their efficacy in the management of chicken diseases as follows: 1 = least, 2 = good, 3 = very good, and 4 = excellent [27].

Results

Socio-demographic characteristics of the respondents

The socio-demographic characteristics of the study population are shown in Table 1. One hundred fifty farmers (61.3% female and 38.7% male) were interviewed on the plants they used to treat and manage chicken diseases. The respondents per village were Nsakya (27.3%), Buwoola (17.3%), Kabanga (17.3%), Kinoni (34%) and Buvunya (4%). Most of the respondents had attained primary education (54.7%), were Catholic (42.7%), married (63.3%), and practiced farming (56%).

Ethnoveterinary knowledge acquisition and use of medicinal plants to treat chicken diseases

All farmers used medicinal plants to treat chicken diseases with 4.7%, 24.2%, 50%, and 21.5% using it for one [1], two [2], three [3], and more than three [3] plants respectively. The majority of chicken farmers acquired ethnoveterinary knowledge from their relatives (84.7%) and only 15.3% from other herbalists. Most plants were used singly

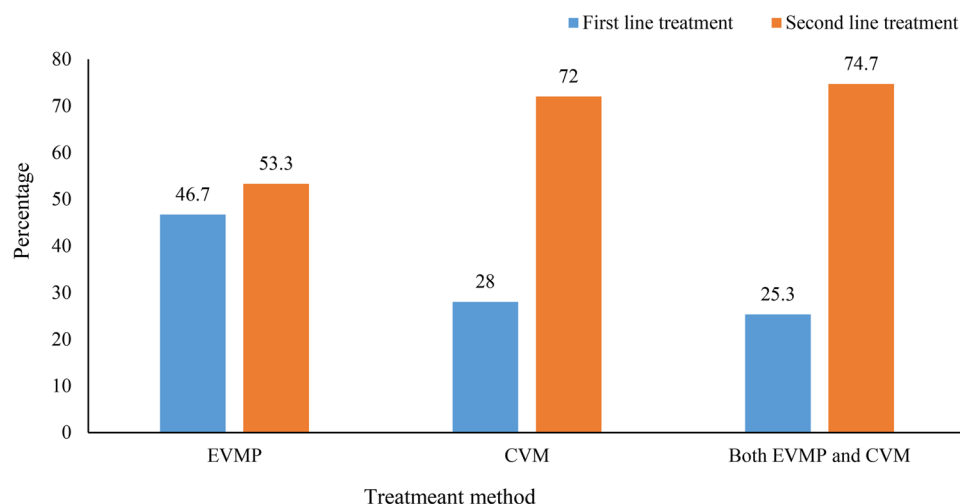


Fig. 2 Treatment options used by poultry farmers in Najjembe sub-county, Buikwe district

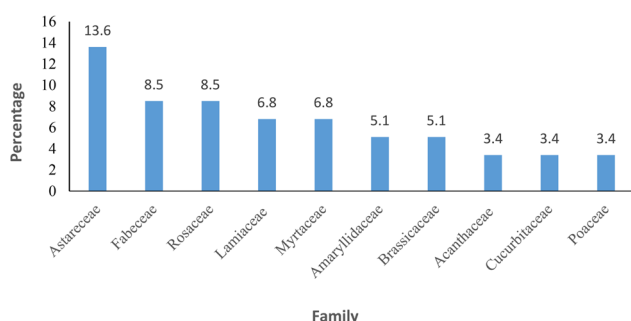


Fig. 3 Percentage of ethnoveterinary medicinal plant species in the different families

(64.7%) as opposed to combination (35.3%) in preparation of herbal medicine. On falling sick, the majority of the chicken farmers (46.7%) reported that they used ethnoveterinary medicinal plants (EVMP) alone as the first line of treatment compared to 28% who used conventional veterinary medicine (CVM) alone. When the chicken failed to improve, the farmers sought a combination of both EVMP and CVM. Thus, on re-treatment, the number of farmers that used EVMP alone decreased to 53.3%, while those who used conventional veterinary medicine increased and the highest score on re-treatment was for those who used both EVMP and conventional veterinary medicine (Fig. 2). In the context of our study, chicken farmers used ethnoveterinary botanical remedies as the first treatment for chicken diseases before attempting to use CVM.

Plant species used in the preparation of ethnoveterinary botanical remedies for chicken in Najjembe sub-county

Fifty-nine plant species were mentioned by poultry farmers in this study to be used in the preparation of ethnoveterinary botanical remedies (EBR) for the management of chicken diseases (Additional file 1). These

species belonged to 59 genera and 31 families. Families that had the most species were Asteraceae ($n=8$, 13.6%), Fabaceae ($n=5$, 8.5%), Rosaceae ($n=5$, 8.5%), Myrtaceae ($n=4$, 6.8%) and Lamiaceae ($n=4$, 6.8%) (Fig. 3). Seven plant species were mentioned by ten or more farmers. These were; *Aloe vera* (L) Burm.f. (64), *Bidens pilosa* L [12], *Cannabis sativa* L [49], *Momordica foetida* Schumacher [10], *Capsicum frutescens* L. (60), *Nicotiana tabacum* L. (55), *Cyphostemma adenocaulum* (Steud. ex (A) Rich.) Desc. ex Wild & R. (B) Drumm [29]. Most species were herbs (45.8%), and trees (25.4%). Most farmers used leaves (66.1%) for preparing their ethnoveterinary botanical remedies (Fig. 4). The commonest method of preparation was decoction (38.9%) (Fig. 5) and most of the preparations were administered orally (96.6%). According to preference ranking, *Aloe vera* (L) Burm.f. was most preferred followed by *Capsicum frutescens* L., (Table 2). From the pairwise ranking of the five most effective plants for treating chicken diseases, *Aloe vera* (L) Burm.f. ranked first with a score of 38 followed by *Capsicum frutescens* L. with a score of 32 (Table 3). For most of the chicken diseases, there was consensus on the medicinal plants used to treat them with most medicinal plants having the informant consensus factor above 0.7 (Table 5). For example, *Nicotiana tabacum* L. had ICF values of 0.98, 0.98, 0.90, 0.98, 0.86 and 0.88 for swollen eyes, manson's eye worm, eye infections, diarrhea, fowl typhoid and flu. The majority of the species were taken orally, except *Jatropha curcas* L. and *Phaseolus lunatus* L. which were administered ophthalmically (Table 4 and additional file 1).

More than half (61.3%) of the farmers collected ethnoveterinary medicinal plants from the forest while others harvested them from the garden (19.3%), grazing land (10%), and compound (9.3%) (Fig. 6). About half of the farmers (49.3%) grew chicken-treating plants in their

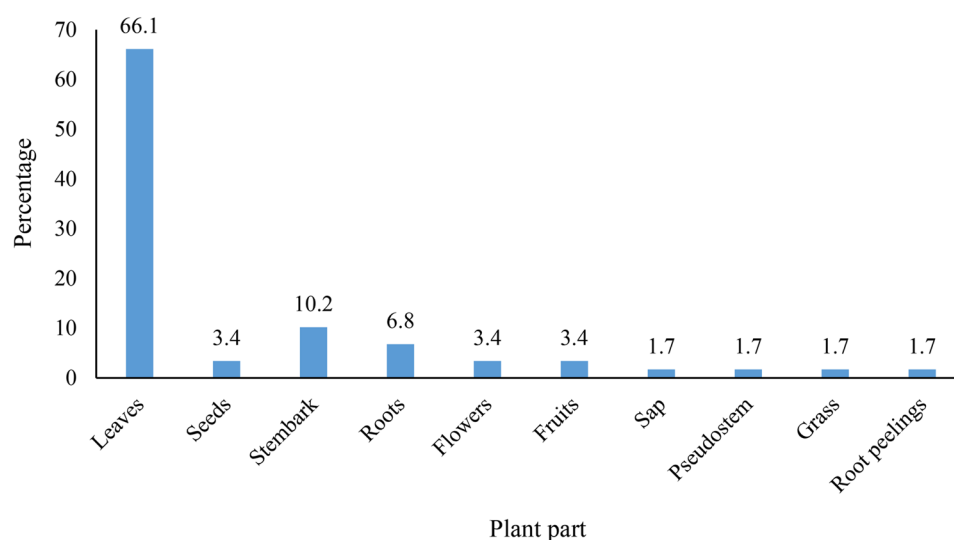


Fig. 4 Plant parts used in the treatment of chicken diseases in Najjembe sub-county

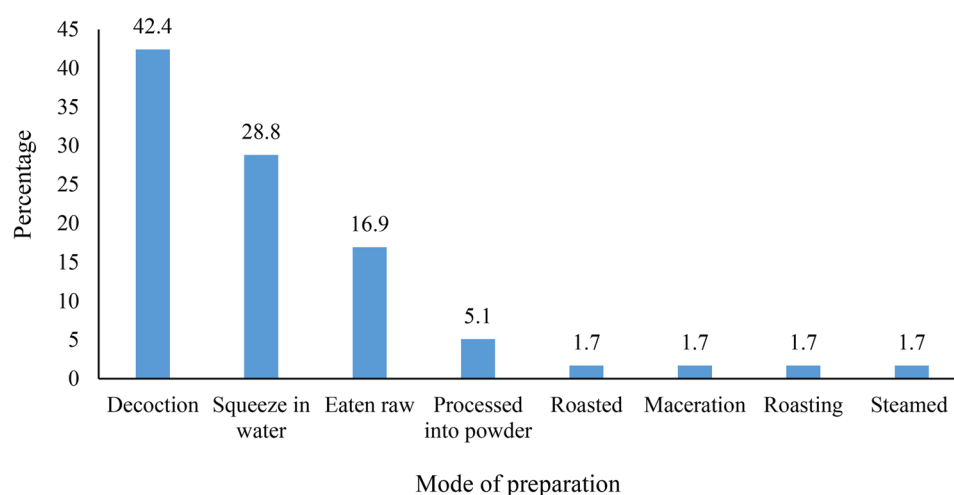


Fig. 5 Preparation methods for ethnoveterinary botanical remedies used in the treatment of chicken diseases in Najjembe sub-county

Table 2 Preference ranking of medicinal plants used for treating chicken diseases in Najjembe sub-county, Buikwe district

Medicinal plant	Respondents							Score	Rank
	R ₁	R ₂	R ₃	R ₄	R ₅	R ₆	R ₇		
<i>Cannabis sativa</i> L.	2	5	3	3	2	3	5	23	3rd
<i>Nicotiana tabacum</i> L.	3	3	4	2	5	3	2	22	4th
<i>Aloe vera</i> (L) Burm.f.	4	5	5	5	3	3	4	29	1st
<i>Cyphostemma adenocaula</i> (Steud. ex (A) Rich.) Desc. ex Wild & R. (B) Drumm.	3	4	3	2	2	3	4	21	5th
<i>Capsicum frutescens</i> L.	3	3	3	4	4	4	2	23	2nd
<i>Bidens pilosa</i> L.	3	2	2	3	4	3	2	19	6th

gardens and compounds. These included *Aloe vera* (L) Burm.f. (42.2%), *Capsicum frutescens* L. (16.2%), *Nicotiana tabacum* L. (20%), and *Cannabis sativa* L. (21.6%). On the other hand, some farmers bought some of the medicinal plants from the market, especially *Cannabis sativa*. Majority of the farmers (67.3%) believed that the herbal medicines used to treat chicken were highly

effective with a big proportion (72.2%) not preserving their ethnoveterinary botanical remedies. Of those who preserved them, 61% simply put them in bottles at room temperature (Fig.7). Despite the frequent use of botanical remedies to treat chicken, farmers faced several challenges, the major challenge being failure to determine the right dose to administer when chicken fell sick since their

Table 3 Paired comparison on five commonly used medicinal plants used for treating chicken diseases in Najjembe sub-county, Buikwe district

Medicinal plants	Respondents										Score	Rank
	R ₁	R ₂	R ₃	R ₄	R ₅	R ₆	R ₇	R ₈	R ₉	R ₁₀		
<i>Cannabis sativa</i> L.	2	4	3	3	2	3	3	2	2	4	28	3rd
<i>Nicotiana tabacum</i> L.	3	3	4	2	3	3	2	2	2	3	27	4th
<i>Aloe vera</i> (L.) Burm.f.	4	3	4	4	4	4	4	4	3	4	38	1st
<i>Cyphostemma adenocaula</i> (Steud. ex (A) Rich.) Desc. ex Wild & R. (B) Drum.	3	3	3	2	2	3	2	2	3	2	25	5th
<i>Capsicum frutescens</i> L.	3	3	3	4	4	4	2	3	3	3	32	2nd

medicines are not standardized (Fig. 8). The other challenge was scarcity of medicinal plants as a result of the escalating deforestation of Mabira Central Forest Reserve that is their primary source of medicinal plants (Fig. 8).

Discussion

The use of medicinal plants in the preparation of ethnoveterinary medicine (EVM) continues to gain momentum in developing countries [28]. In Buikwe district, there is a rich biodiversity of ethnoveterinary medicinal plants used by chicken farmers to prepare EVM for the management of several chicken diseases. Chicken farmers in Buikwe district have rich indigenous knowledge of EVMP thus the majority of the respondents practiced EVM either as a first-line or second-line treatment option for their poultry. Traditional beliefs that EVM is effective, safe, affordable, readily available, and simple to use as compared to conventional veterinary medicine (CVM) could be responsible for the widespread use of EVM in Buikwe district [9, 29]. Additionally, the use of phytogens in animal feed is growing widely due to their health and nutritional benefits [30]. Like other rural areas in Uganda, CVM is not affordable to the farmers and often sold in veterinary drug shops which are often very far. The situation is complicated further by the high levels of poverty in the area as evidenced by the majority of the farmers practicing subsistence poultry farming [31, 32]. A combination of these factors hinders access to CVM causing chicken farmers to find alternative treatment options of which EVM is the most utilized. Similarly, rural farmers in South Africa use EVM as a first-line option to manage poultry diseases citing similar reasons [33].

Ethnoveterinary medicine in Uganda, particularly in the treatment of poultry diseases, offers a valuable reservoir of indigenous knowledge and plant-based remedies that have been utilized for generations [34, 35]. Integrating such knowledge into modern veterinary practice can strengthen animal healthcare systems, particularly where conventional veterinary services are limited. Scientific validation of commonly used herbal treatments for poultry diseases like Newcastle disease, coccidiosis, and helminth infections could lead to the development of safe, standardized, and efficacious formulations [33]. This integration supports the One Health approach, which recognizes the interconnectedness of human, animal, and environmental health, and seeks collaborative solutions to global health threats. Moreover, leveraging ethnoveterinary knowledge may reduce the misuse of synthetic drugs, thereby contributing to the mitigation of antimicrobial resistance (AMR), a growing global concern linked to the overuse of antibiotics in livestock production [36]. Therefore, fostering collaboration between traditional healers, veterinary researchers, and policy-makers is essential to bridge the gap between traditional

Table 4 The most common chicken disease conditions treated with botanical remedies, mode of Preparation and route of administration

Disease/Condition	Species	Plant part	Preparation	Dosage
Flue and excessive salivation	<i>Nicotiana tabacum</i> L.	Leaves	Squeeze all in water and add ash	Add the mixture to water and pour into a drinking trough for 3 days
	<i>Tetradenia riparia</i> (Hochst.) Codd.			
	<i>Cannabis sativa</i> L.	Leaves	Decoction	Add the decoction to water and put into a drinking trough for 3 days
	<i>Cucurbita maxima</i> Lam.	Roots		
	<i>Azadirachta indica</i> A. Juss.	Leaves	Decoction	Add decoction to water and put into a drinking trough for 5 days
	<i>Allium sativum</i> L.	Half Bulb		
	<i>Capsicum frutescens</i> L.	Fruits	Squeeze in water and add charcoal soot	Add the mixture with water and pour into a drinking trough for 2 days
	<i>Acanthus pubescens</i> (Thomson ex Oliv.) Engl	Leaves and Roots	Smoke in the chicken house	Smoke in the chicken house for one week
Fowl typhoid	<i>Aloe vera</i> (L.) Burm.f.	Leaves	Squeeze in water	Add the mixture to water and pour into a drinking trough for 5 days
	<i>Cyphostemma adenocaula</i> (Steud. ex (A) Rich.) Desc. ex Wild & R. (B) Drumm.			
	<i>Azadirachta indica</i> A. Juss.			
	<i>Cannabis sativa</i> L.			
	<i>Aristolochia saccata</i> Wall.	Seeds		
	<i>Nicotiana tabacum</i> L.	Leaves	Decoction	Add the decoction to water and pour into a drinking trough for 6 days
Diarrhoea	<i>Gymnanthemum amygdalinum</i> (Delile) Sch.Bip. (Syn: <i>Vernonia amygdalina</i> Delile)	Roots		
	<i>Erythrina abyssinica</i> Lam. ex DC	Flowers	Squeeze in water and add ash	Add the mixture to water and pour into a drinking trough for one day
	<i>Nicotiana tabacum</i> L.	Leaves		
Avian intestinal coccidiosis	<i>Pytolacca dodecandra</i> L Herit.	Leaves	Squeeze in water and add ash	Add mixture to water and pour into a drinking trough for one day.
	<i>Tetradenia riparia</i> (Hochst.) Codd.			
	<i>Combretum collinum</i> Fresen.	Roots	Decoction	Add decoction to water and pour into a drinking trough for one day
Eye infections	<i>Moringa oleifera</i> Lam.	Leaves		
	<i>Cannabis sativa</i> L.			
	<i>Nicotiana tabacum</i> L.	Leaves	Squeeze in water	Put two drops in the eye two times a day until the chicken heal
	<i>Psidium guajava</i> L.	Fruits	Eaten fresh	Hang fresh leaves in the chicken house for one week
	<i>Hoslundia opposita</i> Vahl.	Leaves	Steam all together and squeeze out the fluid	Put three drops in the eye three times a day until the chicken heal
	<i>Desmodium salicifolium</i> (Poir.) D.C.			
Manson's eye worm	<i>Lantana camara</i> L.			
	<i>Phaseolus lunatus</i> L.			
	<i>Ocimum gratissimum</i> L. Susp.			
	<i>Nicotiana tabacum</i> L.	Leaves	Mix the two, extract, add ash and kerosene, and use car oil	Put two drops in the eye three times a day until the chicken heal and also spray the mixture in the chicken house
	<i>Allium cepa</i> L.	Bulb		
	<i>Momordica foetida</i> Schumach.	Leaves	Decoction	Add the decoction to water and pour into a drinking trough for one week
	<i>Gymnanthemum amygdalinum</i> (Delile) Sch.Bip. (Syn: <i>Vernonia amygdalina</i> Delile)			
Body weakness	<i>Prunus africana</i> (Hook.f.) Kalkman	Stem bark		
	<i>Cucurbita maxima</i> Lam.	Fruits and Flowers	Grind to powder	Add the powder to water and put into a drinking trough for one day
	<i>Capsicum frutescens</i> L.	Fruits		

Table 4 (continued)

Disease/Condition	Species	Plant part	Preparation	Dosage
Helminthiasis	<i>Carica papaya</i> L.	Fruits and Seeds	Squeeze in water	Add the mixture with water and pour into a drinking trough for three days
	<i>Pytolacca dodecandra</i> L Herit.	Leaves		
	<i>Euphorbia heterophylla</i>	Seeds		
	<i>Euphorbia heterophylla</i>	Seeds	Squeeze in water	Add the mixture with water and pour into a drinking trough for 3 days
	<i>Combretum collinum</i>	Leaves		
	<i>Capsicum frutescens</i> L.	Fruits	Decoction	Add the decoction with water and pour into a drinking trough for three days
	<i>Gymnanthemum amygdalinum</i> (Delile) Sch.Bip. (Syn: <i>Vernonia amygdalina</i> Delile <i>Erythrina abyssinica</i> Lam. ex DC	Roots		
Cough	<i>Azadirachta indica</i> A. Juss.	Leaves	Decoction	Add the decoction with water and pour into a drinking trough for two days
	<i>Capsicum frutescens</i> L.	Fruits	Crush and mix with water, then add ash	Add the mixture with water and pour into a drinking trough for five days
	<i>Carica papaya</i> L.	Roots		
	<i>Cannabis sativa</i> L.	Leaves	Squeeze in water and add ash	Add the mixture with water and pour into a drinking trough for five days
	<i>Nicotiana tabacum</i> L.			
Splenomegaly	<i>Colocasia esculenta</i> (L.) Schott	Leaves	Tie fresh leaves in bundles	Hang the fresh leaves in the chicken house for a week
	<i>Cyphostemma adenocaula</i> (Steud. ex (A) Rich.) Desc. ex Wild & R. (B) Drumm.,			
Eye Worm	<i>Tetradenia riparia</i> (Hochst.) Codd.	Leaves	Squeeze in water	Put three drops on the eyes and nose three times a day for three days
	<i>Crassocephalum vitellinum</i>			
	<i>Kalanchoe pinnata</i>			
Wounds on chicken eyes	<i>Gymnanthemum amygdalinum</i> (Delile) Sch.Bip. (Syn: <i>Vernonia amygdalina</i> Delile <i>Bidens pilosa</i> L.	Leaves	Squeeze in water	Put on the wounds till when they heal
Intestinal worms	<i>Carica papaya</i> L.	Seeds	Crush and mix in water	Add the mixture with water and pour into a drinking trough for five days
	<i>Capsicum frutescens</i> L.	Fruits		
Poor quality eggs	<i>Cyphostemma adenocaula</i> (Steud. ex (A) Rich.) Desc. ex Wild & R. (B) Drumm.,	Leaves	Tie fresh leaves in bundles	Always hang the fresh leaves in the chicken house
	<i>Colocasia esculenta</i> (L.) Schott	Leaves		
	<i>Amaranthus dubius</i> Thell.	Leaves		
Coccidiosis	<i>Aloe vera</i> L.	Leaves	Squeeze the leaves in water and add crushed Cannabis seeds	Add the mixture with water and pour into a drinking trough for seven days
	<i>Cannabis sativa</i> L.	Leaves and Seeds		

and modern veterinary medicine and improve poultry health in Uganda.

In Uganda, chickens are deeply woven into the socio-cultural fabric of rural communities, serving not only as sources of income and nutrition but also as symbols of wealth, social status, and spiritual significance. They play key roles in traditional rituals, including bride price exchanges, conflict resolution, cleansing ceremonies, and ancestral offerings [3, 37]. As such, maintaining the health of chickens is a communal priority, and ethnoveterinary medicine (EVM) has emerged as a culturally embedded system for disease management. Remedies

are often administered by elders or custodians of indigenous knowledge, using plant-based treatments passed down orally [38]. These practices are not only practical but also reflect a worldview where animal health is interlinked with social harmony and spiritual balance [29]. Integrating this indigenous knowledge into modern veterinary practices could enhance culturally sensitive animal healthcare and promote community engagement in animal health programs. By standardizing and integrating EVM into animal health care systems, better treatment outcomes will be achieved thereby contributing to national food security and agricultural productivity.

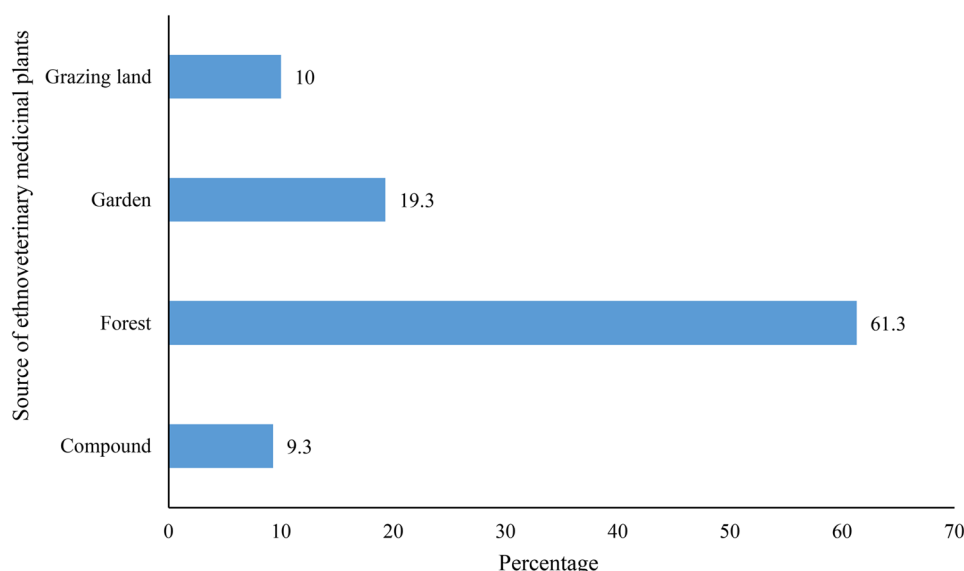


Fig. 6 Source of ethnoveterinary medicinal plants used by poultry farmers in Najjembe sub-county, Buikwe district

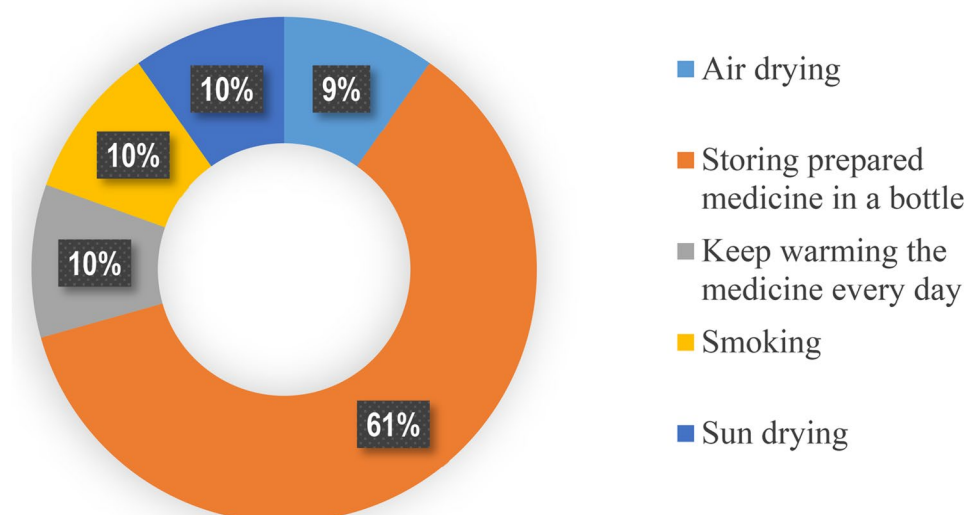


Fig. 7 Preservation methods used by poultry farmers in Najjembe sub-county, Buikwe district

The fifty nine (59) medicinal plant species reported from one subcounty indicates the rich medicinal plant species diversity in the area. This number is higher than that reported from two districts of Mpigi and Gulu combined but is lower than that of Jinja district which is a nearby district [9, 29]. Although Najjembe subcounty and Jinja district are near each other, our study reported a smaller number because it was conducted in one sub-county which is geographically smaller than a district of Jinja. Over 20 species in this study were also reported by other studies conducted in Jinja (Eastern Uganda), Mpigi (Central Uganda) and Gulu (Northern Uganda). These include *Aloe vera* (L.) Burm.f., *Capsicum frutescens* L., *Nicotiana tabacum* L., *Cannabis sativa* L., *Momordica*

foetida Schumach., *Erythrina abyssinia* Lam. ex DC., *Vernonia amygdalina* Del., *Moringa oleifera* A. Juss., *Carica papaya* L., *Phytolacca doceandra* L Herit., *Azadirachta indica* A. Juss., *Hoslundia opposita* Vahl., among others [9, 29]. Interestingly our study reports medicinal plants that have not been previously reported in any region of Uganda. These include *Cyphostemma adenocaula*, *Tetradenia riparia*, *Cardamine trichocarpa*, *Sigesbeckia orientalis*, *Colocasia esculenta*, *Aspilia africana*, and *Nicotiana betonica* (L.) Lindau (Syn: *Justicia betonica*).

Most of the EVMP used to manage chicken diseases belonged to the family Asteraceae, Fabaceae, and Lamiaceae. These families are known to produce secondary metabolites with bioactivity against several pathogens

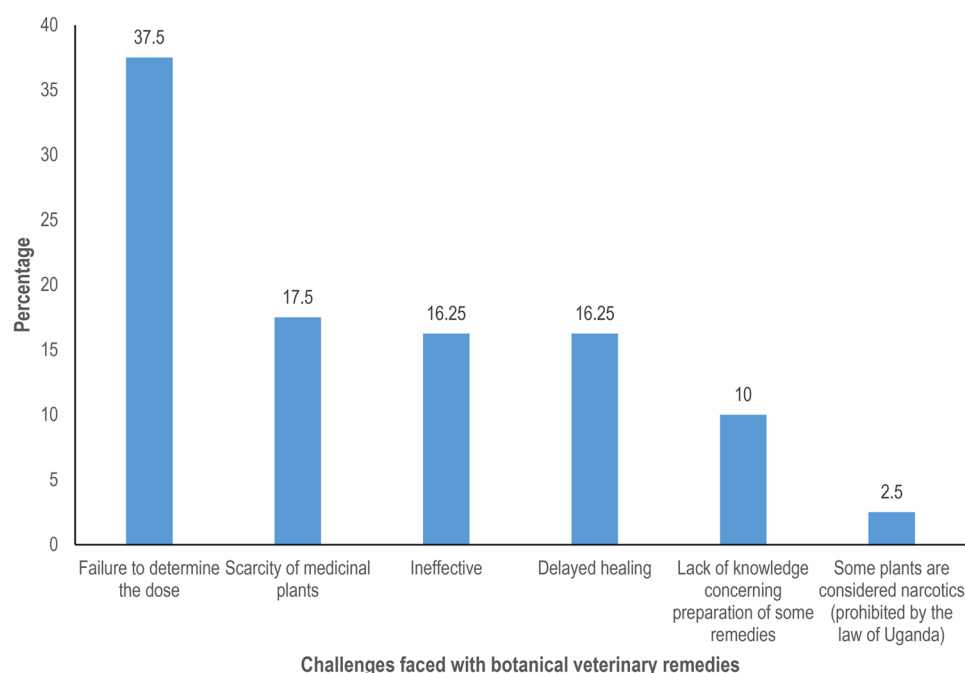


Fig. 8 Challenges faced by farmers when using ethnoveterinary botanical remedies

that cause diseases in poultry [33, 34, 39]. It is also plausible that these families are the most represented because of their high species abundance in Buikwe district compared to other families [32]. The leaves were the predominant part harvested for the preparation of EVM and this has been reported in several other studies worldwide. This is because apart from being simple to harvest, they allow sustainable harvesting which promotes conservation of the medicinal plant species [40]. Most EVM were prepared as decoctions and administered orally to the diseased chicken. Boiling plant materials increases the concentration of the bioactive ingredients and this makes the EVM more effective. The oral route was the most preferred route of administration because apart from being simple and convenient to use, it does not require skilled personnel and equipment [41]. Preparing EVM from a single plant species was more common than combinations. Although it is known that polyherbal therapies are usually more effective than monotherapies due to the synergistic interactions among the different phytochemical compounds, However, we think that probably EVM was employed in the management of mild to moderately diseased poultry. In Pakistan and South Africa, livestock farmers also prepared their EVM using single plant species [33, 40]. A close analysis of the reported medicinal plants for management of chicken diseases reveals that majority of them are also used in management of human ailments that present with related signs and symptoms [13–21]. Foreexample, *Azadirachta indica* A. Juss., *Allium sativum* L., *Capsicum frutescens* L. and *Cannabis sativa* L. are used in treatment of respiratory tract illnesses such

as flu and cough while *Gymnanthemum amygdalinum* (Delile) Sch.Bip. (Syn: *Vernonia amygdalyne* Delile) and *Aloe vera* (L.) Burm.f. are used in conditions that present with fever such as malaria and typhoid [32, 41]. This suggests there is some convergence in the use of medicinal plants in the management of both livestock and human diseases and resonates with the common practice of farmers using common human medicines for veterinary purposes.

Forests are natural habitats for medicinal plant species. Forest-harvested samples are usually less contaminated with environmental toxicants making them have better quality as pharmaceutical raw materials than other samples harvested from the garden or open grasslands [42–44]. Domesticating medicinal plant species around homesteads and gardens is an indigenous practice aimed at conserving them but also ensuring easy access to otherwise difficult-to-get plant species. Although there were some indications of knowledge sharing among the community members, indigenous knowledge and practices were held as a secret and usually transferred to close family members [45]. Determination of appropriate dose and frequency of administration of EVM remains a huge challenge among all farmers. Farmers administered EVM for weeks or months until they saw physical changes in the health of the chicken. There were inconsistencies in the administration of medicines which could result in treatment failure or toxicity. This challenge has been reported globally and calls for standardization of EVM to ensure consistency in the composition of the EVM [28, 46]. Lack of suitable packing and poor storage and preservation of

Table 5 Summarizing the use reports and informant consensus factor (ICF) of medicinal plants used in management of selected chicken disease

Chicken disease	Medicinal plant species	Use reports for ailment	No. of species used for the same ailment	ICF Value
Flue and excessive salivation	<i>Nicotiana tabacum</i> L.	58	8	0.88
	<i>Capsicum frutescens</i> L.	65	8	0.89
	<i>Tetradenia riparia</i> (Hochst.) Codd.	13	8	0.42
	<i>Cannabis sativa</i> L.	52	8	0.86
	<i>Cucurbita maxima</i> Lam.	12	8	0.36
	<i>Azadirachta indica</i> A. Juss.	10	8	0.22
	<i>Allium sativum</i> L.	13	8	0.42
Fowl typhoid	<i>Acanthus pubescens</i> (Thomson ex Oliv.) Engl	11	8	0.30
	<i>Aloe vera</i> (L.) Burm.f.	65	7	0.91
	<i>Cyphostemma adenocaula</i> (Steud. ex (A) Rich.) Desc. ex Wild & R. (B) Drumm.	20	7	0.68
	<i>Azadirachta indica</i> A. Juss.	40	7	0.85
	<i>Cannabis sativa</i> L.	50	7	0.88
	<i>Aristolochia saccata</i> Wall.	35	7	0.82
	<i>Nicotiana tabacum</i> L.	45	7	0.86
Diarrhea	<i>Gymnanthemum amygdalinum</i> (Delile) Sch.Bip. (Syn: <i>Vernonia amygdalyne</i> Delile)	55	7	0.89
	<i>Erythrina abyssinica</i> Lam. ex DC	10	2	0.89
Avian intestinal coccidiosis	<i>Nicotiana tabacum</i> L.	48	2	0.98
	<i>Phytolacca dodecandra</i> L Herit.	11	5	0.60
	<i>Tetradenia riparia</i> (Hochst.) Codd.	17	5	0.75
	<i>Combretum collinum</i> Fresen.	8	5	0.43
	<i>Moringa oleifera</i> Lam.	20	5	0.79
Eye infections	<i>Cannabis sativa</i> L.	49	5	0.92
	<i>Nicotiana tabacum</i> L.	60	7	0.90
	<i>Psidium guajava</i> L.	8	7	0.14
	<i>Hoslundia opposita</i> Vahl.	45	7	0.86
	<i>Desmodium salicifolium</i> (Poir.) D.C.	23	7	0.73
	<i>Lantana camara</i> L.	14	7	0.54
	<i>Phaseolus lunatus</i> L.	10	7	0.33
Manson's eye worm	<i>Ocimum gratissimum</i> L. susp.	15	7	0.57
	<i>Nicotiana tabacum</i> L.	48	2	0.98
Fowl pox	<i>Allium cepa</i> L.	16	2	0.93
	<i>Momordica foetida</i> Schumach.	17	3	0.88
	<i>Prunus africana</i> (Hook.f.) Kalkman	34	3	0.94
Body weakening	<i>Gymnanthemum amygdalinum</i> (Delile) Sch.Bip. (Syn: <i>Vernonia amygdalyne</i> Delile)	8	3	0.71
	<i>Cucurbita maxima</i> Lam.	13	2	0.92
	<i>Capsicum frutescens</i> L.	40	2	0.97
Intestinal worms	<i>Carica papaya</i> L.	60	6	0.92
	<i>Phytolacca dodecandra</i> L Herit.	50	6	0.90
	<i>Senna spectabilis</i> (DC.) Irwin & Barneby.	52	6	0.90
	<i>Capsicum frutescens</i> L.	35	6	0.85
	<i>Gymnanthemum amygdalinum</i> (Delile) Sch.Bip. (Syn: <i>Vernonia amygdalyne</i> Delile)	9	6	0.38
Swollen eyes	<i>Erythrina abyssinica</i> Lam. ex DC	27	6	0.81
	<i>Nicotiana tabacum</i> L.	50	2	0.98
	<i>Lantana camara</i> L.	42	2	0.98

EVM was another challenge that affected their quality. Some of the storage materials used included old or recycled plastic bottles and jerricans, polyethylene bags, and newspapers that were unhygienic and thus could potentially contribute to the contamination of the herbal medicines [41].

The threat to loss of medicinal plants and other biodiversity is escalating globally due to climate change and anthropogenic activities such as charcoal burning, search for construction materials, and human settlement in protected areas [47, 48]. Like in any other region in Uganda, poverty is the main driver of rampant deforestation that

has accelerated forest loss. Uncontrolled deforestation has also contributed to prolonged droughts experienced in the region exacerbating the loss of vital medicine plants. In Ethiopia charcoal burning, construction, firewood and prolonged droughts were responsible for the decline in plant diversity [49]. The chicken farmers called upon government to set up strict policies and regulations so as to preserve the forests so as to conserve the threatened medicinal plants.

Conclusion

There are important medicinal plants majorly belonging to the family Asteraceae and Fabaceae used in the preparation of ethnoveterinary medicines for the management of chicken diseases in Najjembe sub-county, Buikwe district. This rich diversity of ethnopoultry medicinal plants indicate good prospects for development of novel ethnopoultry drugs that might provide a solution to the escalating resistance against conventional poultry drugs. However, there is an urgent need to conserve the reported plant species against the increasing threats of deforestation, climate change, human settlement and agricultural expansion. The phytochemical constituents, pharmacological and nutritional activity as well as toxicity profiles of the unstudied medicinal plant species with high percentage use values should be investigated to validate their uses in the management of chicken diseases in an effort to discover novel drugs. The veterinary medicinal practitioners and government should consider supporting the local farmers with standardization of the ethnopoultry medicines to improve the quality for integrated use along with conventional veterinary medicines.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12917-025-05008-z>.

Supplementary Material 1.

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Authors' contributions

AN and GA conceived the research idea, were involved in field data collection and manuscript writing, and were the overall supervisors of the project. AW and SBO were involved in data analysis and manuscript writing. NC was involved in data collection and manuscript writing. All the authors proofread and approved the final draft of the manuscript.

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Data availability

This article has all the required data.

Declarations

Ethics approval and consent to participate

Before the commencement of the study, the study protocol was reviewed and approved by the Makerere University School of Health Sciences Research and Ethics review board (MAKSHSREC-2020-74). All respondents were asked for their consent and had to sign a prior informed consent form after the objectives and possible consequences of the study had been explained to them. The prior informed consent (PIC) was written in the Luganda language. Permission to access Najjembe sub-county for this study was given by the local area administration.

Consent for publication

The participants consented in writing to grant the publication of study results.

Competing interests

The authors declare no competing interests.

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