An ethnoveterinary survey of medicinal plants used to treat poultry diseases in drylands of Zimbabwe

Vimbai Gobvu, Xavier Poshiwaa and Mudadi Albert Benhura

Correspondence

Vimbai Gobvu*[1,3], Xavier Poshiwa[1] and Mudadi Albert Benhura[2]

[1]Department of Livestock, Wildlife and Fisheries, Gary Magadzire School of Agriculture and Engineering, Great Zimbabwe University, Private Bag 1235, Masvingo, Zimbabwe.
[2]Department of Biochemistry, School of Medical and Health Sciences, Great Zimbabwe University, Private Bag 1235, Masvingo, Zimbabwe.
[3]Department of Animal Production Sciences, Faculty of Plant and Animal Sciences, Marondera University of Agricultural Sciences and Technology, Post Office Box 35, Marondera, Zimbabwe.

Corresponding author: vgobvu@gmail.com

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Research

Abstract

Background: The major constraints in the production of poultry by rural farmers include predation, poor nutrition and diseases leading to high mortality rates. Conventional drugs are either unavailable or too expensive for resource-poor farmers.

Methods: An ethnoveterinary survey was done in Chiredzi, Chivi and Mwenezi districts of Masvingo province in order to identify diseases that affect poultry in drylands and to identify plants that are used to treat the diseases. Two hundred and seventy farmers were interviewed through a semi-structured questionnaire in vernacular language. Frequency of responses was obtained using IBM SPSS Statistics 23 and informant consensus factor (FiC) for different ailments were calculated. Scoring and ranking was done to identify the most used *Aloe* species in treating poultry diseases.

Results: Twelve poultry ailments were identified with diarrhoea (46.7%) being the most common. Thirty-two plant species were used in the study area for managing poultry diseases. Respiratory diseases had the highest FiC of 0.87. *Aloe* species were mentioned by 74.4% of the respondents. Of the *Aloe* species available and used in the districts; *Aloe aculeata* was the most used for managing poultry ailments. Most of the plants reported as being used to treat poultry diseases belonged to the Fabaceae family. Leaves were the most used plant part for treating poultry ailments.

Conclusions: Thirty-two plants from twenty plant families were used to treat various poultry ailments in dryland communities in Chiredzi, Chivi and Mwenezi. Aloe species were the most used plants. *Aloe aculeata* and *Lippia oatessi* have not been previously reported as being used for poultry health management. This study is useful in providing documentation of ethnoveterinary plants utilized by Zimbabwean dryland inhabitants to manage poultry health.

Keywords: Ethnoveterinary, poultry, parasites, diseases, drylands, herbal, traditional, conventional

Background

Traditionally managed small-scale family-based systems of producing poultry play an important role in sustaining the livelihood of the people in SSA (Erdaw & Beyene 2022). In Zimbabwe, the poultry industry relies for breeding stock on both the indigenous strains, commonly referred to as free range poultry, and imported strains (Zengeni 2014). As in other developing countries, the production of chicken has a dual nature, comprising of large and small-scale producers (Mapiye *et al.* 2008). Commercial breeding of poultry is based on strains imported from Europe (Zengeni 2014), whereas the indigenous strains are for small-scale producers who are based mainly in rural areas. The commercial sector is characterized by intensive management and mechanization and is dominated by relatively large companies, whereas small scale production includes semi intensive and extensive farming (Pedersen 2002; Mapiye 2008). Extensive rearing systems of poultry can be described as organic, free-range and low-input production systems (Dal Bosco *et al*. 2021)

The rural production of poultry in Zimbabwe is an important income generating activity, predominantly run by women in the small-scale sector (Malapela *et al*. 2016). Management, in the production and performance of poultry in different countries are affected by similar factors (Akinola & Eissen 2011; Erdaw & Beyene 2022). The constraints faced by farmers rearing poultry include high incidence of diseases, poor access to and affordability of veterinary drugs (Mutibvu *et al.* 2012; Gono *et al.* 2013; Gororo & Kashangura 2016). Rural poultry farmers in Africa rely on indigenous knowledge to control various diseases (Gueye 1999; Adedeji *et al*. 2013). In ethnoveterinary medicine, natural products, usually of plant origin, are used for the treatment or the prevention of disease (Desta 2021).

Our objective was to establish a catalogue of diseases that affect poultry in dryland areas and to identify plants that are traditionally and currently used for the management of poultry health in the areas. This baseline information is important for further ethnobotanical research and establishing the cultural and economic values of the plants used for treating poultry diseases. The present study is designed to document existing traditional ethnoveterinary knowledge before it is completely lost to ensure its preservation and to provide an output data for future conservation of medicinal plants.

Materials and Methods

Study area

The study was carried out in Chiredzi, Chivi and Mwenezi districts of Masvingo province (Figure 1, Figure 2). Masvingo province includes Bikita, Chiredzi, Chivi, Gutu, Mwenezi, Masvingo and Zaka districts (Figure 1). The districts fall under natural region 5 (V) (Figure 2). Agro-ecological regions are land areas characterized by similar climate, ecology and agricultural activities (Chikodzi 2012). Agroecological region 5 is characterized by an annual rainfall of less than 650mm in the southern areas of the country with a length of rainfall season between 100 and 120days and maximum temperatures between 28 and 30^{o}C. The region is mostly suitable for livestock production, for example, extensive cattle ranching and goat production (Nyarumbu *et al*. 2019; Gobvu *et al*. 2021). The region is marginal for drought tolerant crops such as sorghum, finger millet, pearl millet and cowpeas. Sugarcane is an ideal crop under irrigation, particularly in the vertisol and siallitic soils.

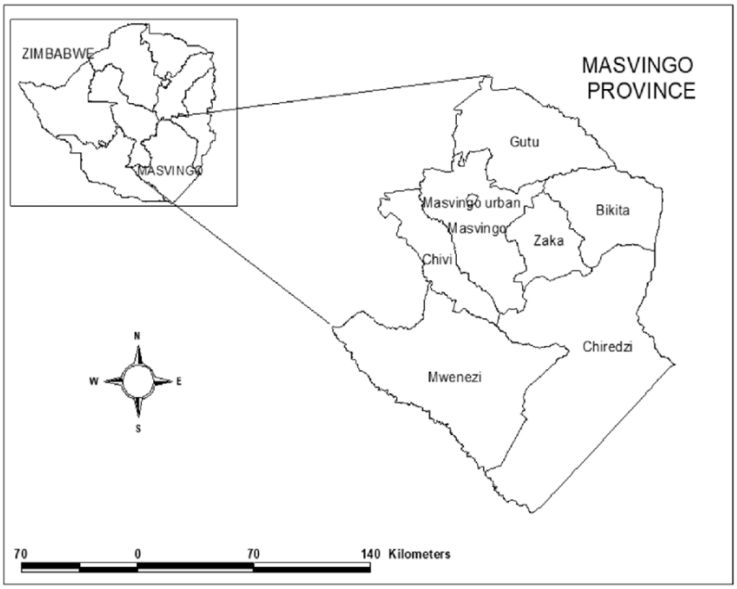

Figure 1. Map of Masvingo Province showing its location in Zimbabwe. Source: (Chapungu et al. 2020).

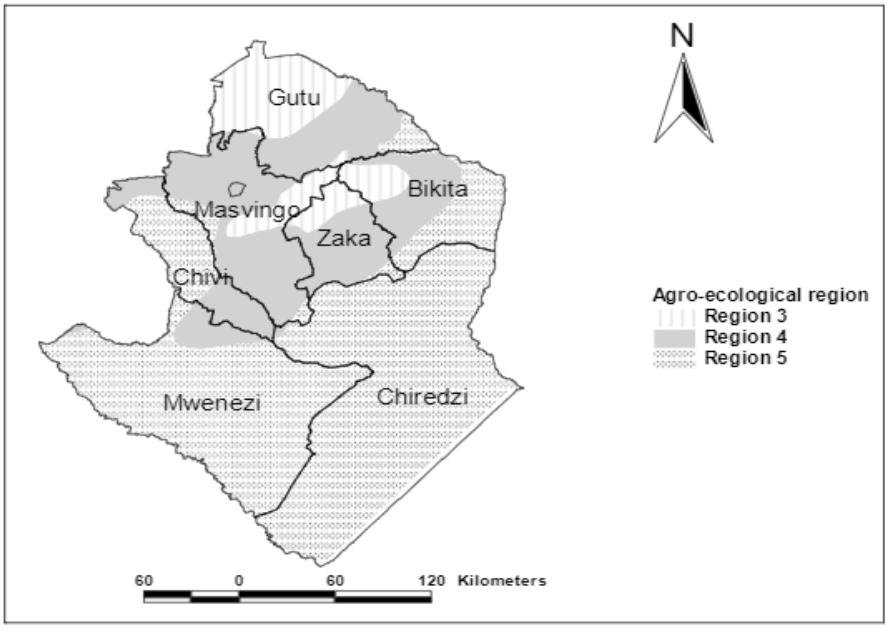

Figure 2. Agroecological zones in Masvingo Province. Source: (Chikodzi et al. 2013).

Sampling

A multistage sampling technique was used for selection of participants for surveys. Zimbabwe is divided into ten provinces. The provinces are subdivided into districts, which, in turn are divided into wards. Wards are subdivided into villages. The province of study, Masvingo, was predetermined by the funding project. Purposive sampling was done from the seven districts of the province to come up with a total of three districts that fell in the driest areas Natural Region five (NR5). One ward was randomly selected from each of the purposively selected districts. Within each ward, five villages were randomly selected from a list of all villages in the ward. Systematic sampling was done to select 18 households that reared poultry from each village. The Cochran's sample size formula (Cochran 1977) was used to determine the sample size of 270 households.

The Cochran's formula for determining the size of a sample is shown below:

$$\mathbf{n = \frac{Z^2 pq}{e^2}}$$

e is the desired level of precision,
p is the estimated proportion of the population which had poultry,
q is 1 – p
Z value is found in the Z table (The standard normal distribution statistical table) (Woolson 1986)
n is the size of the sample

According to the above formula, the sample size was computed. With the assumption that half of the households owned poultry, we have a maximum variability, giving a P value of 0.5. Assuming a 90% confidence interval and at least 0.05 precision, a 90% confidence interval gives Z value of 1.645.

Z=1.645
P=0.5
q=0.5
e=0.05
$\mathbf{n} = (1.645^2)(0.5)(0.5)/(0.05^2)$
n = 270 households.

Collection of survey data

The collection of information on poultry diseases and plants used to manage poultry health in Chiredzi, Chivi and Mwenezi was done through surveys using semi-structured questionnaires. The components of the survey included:

a. Demographic information
b. Types of production systems of poultry and types of poultry kept,
c. Ethnoveterinary knowledge; vernacular names of the plants used, parts the plants used, methods of preparation of remedies, route of administration, description of symptoms treated, vernacular names of diseases
d. Medicinal plants information including; sources of plants and seasons when available and sources of ethnoveterinary knowledge
e. Threats to the existence or expansion of ethnoveterinary plants (EVP)
f. Problems that the respondents face when using EVMs and
g. Reasons why the communities used EVMs.

The interviews were conducted in Shona; a vernacular language common in all the study areas.

Collection and authentication of specimens of plants used for the treatment of poultry diseases

The parts of plants used in the management of poultry health were collected with the assistance of local people. Knives or secateurs were used to cut off the parts of plants to be used. Meshed black nursery bags (10cm by 15 cm) were used to carry samples. Pictures of the plant samples along with field notes were taken using a Canon EOS 2000D camera. Notes taken included field area; that is the village and ward collected from, landforms close, types of rocks and soils in the area, date and time of collection. Specimens were pressed in the field and dried to avoid fungal attack while retaining their colour and arrangement using a 45cm by 30cm plant press. The plant specimens were identified and authenticated by plant taxonomists at the National Herbarium and Botanic Gardens, Zimbabwe. Voucher specimens were deposited at the National Herbarium and Botanic Gardens. The ZimFlora website served as a reference library for the scientific identification of some plants that were used by the farmers.

Ranking of *Aloe* species in focus group discussions

A list of *Aloe* species found in the Lowveld was prepared (Kimberley 1974) Pictures of the Lowveld aloes were printed in colour on A4 bond paper. Two focus group discussions (FGDs) were conducted per district. A participatory scoring system was used to rank the different *Aloe* species from the pictures for their use in poultry health management. Participants were asked to score the different species with the *Aloe* species that they mostly use being given the highest score. Ranking was done and the species with the highest score was ranked first.

Analysis of data

Descriptive and inferential statistics were generated using the SPSS IBM Statistics version 23.0 (IBM Corp, 2015). The frequency of each plant species and diseases were obtained. The frequency of citation was expressed as the number of respondents who mentioned using a certain plant in treating poultry diseases. For most of the diseases, respondents mentioned the names in vernacular language, for example, *chibhubhubhu* for Newcastle disease while they also described other diseases according to symptoms, for example respiratory diseases. The Chi-square test for association was used to determine associations between production type versus health management system used. The effect of production system of poultry on health management system used was analysed. Test for associations were done using the Chi-square test for associations in SPSS.

Informant consensus factor (FiC) was used to estimate the agreement of participants on a number of plant species according to specific use-categories. The FiC is a commonly used index for exploring potentially active medicinal plants for certain ailments (Kazanci *et al*. 2020). FiC values were obtained as follows: number of use-reports in each use category (n_{ur}) minus the number of taxa used (n_t), divided by the number of use-reports in each category minus one, that is, FiC=(nur−nt)/(nur−1); where FiC ranges from 0 to 1. FiC values close to 1 reflect a high agreement on the use of certain plant species on treating a poultry disease. FiC values close to 0 would indicate either a high degree of intracultural variation. Intracultural variation denotes a variation in ethnoveterinary knowledge within a single cultural group.

Results

Demographic information

The socio-demographic characteristics analysed included age, gender and education level attained. Most of the respondents were female (62.2%) and the majority (26.7%) were aged between 40 to 49 years. Most of the respondents (42.6%) had at least eleven years of school.

Information on poultry

Indigenous chickens were the most common poultry type, reared by 260 of the 270 participants interviewed. Layers were the least reared poultry type (five participants). Extensive management systems were the most common (40.7%) followed by semi-intensive management system (33.3%). Farmers who kept poultry under extensive management systems mostly used traditional methods of managing poultry health while those that kept birds under intensive management mostly used both traditional and conventional systems of managing poultry health. Most respondents used traditional methods (58.9%) in managing poultry health. Forty percent of the respondents used both synthetic drugs and traditional methods of managing poultry health while only 1.1% used conventional methods only. There was an association ($P<0.05$) between production system of poultry and health management system used (Table 1).

Table 1. Responses mentioned using different production systems of producing poultry and different systems of managing the health of the birds.

Factor	**Frequency**			**P value**
Production system of birds	**System of health management of poultry**			
	Traditional medicines	Conventional medicines	Both	0.013
Intensive	30	2	41	
Semi-intensive	71	0	31	
Extensive	76	1	46	

Poultry ailments common in the study area

The various poultry ailments that were reported are shown in Figure 3. Diarrhea, the most common disease, was mentioned by 46.7% of the respondents. Respiratory diseases; which were second, were mentioned by 37% of the respondents. The least problematic poultry ailments were loss of appetite and snake bites (Figure 3).

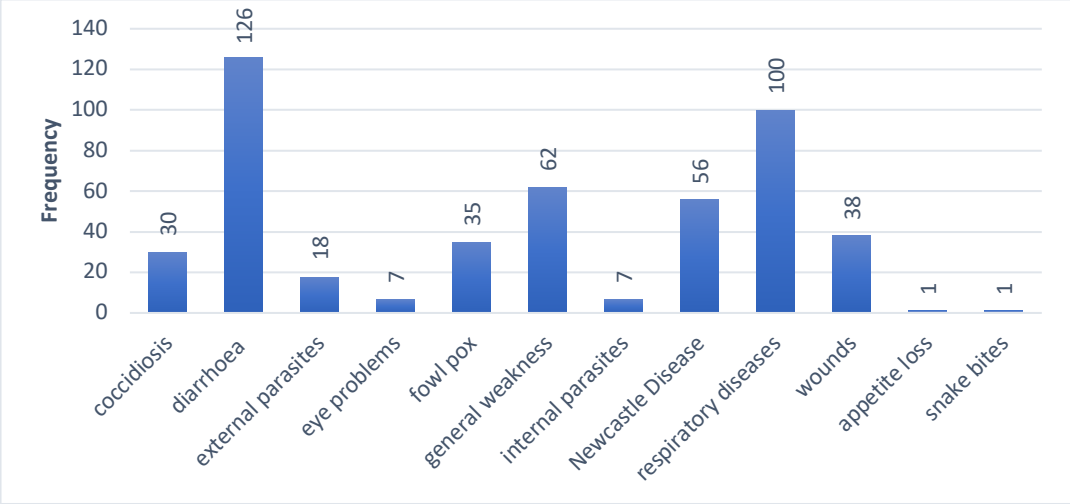

Figure 3. Poultry ailments reported in Mwenezi, Chivi and Chiredzi Districts. The frequency is expressed as the number of respondents that mentioned a certain disease.

Ethnoveterinary plants used for treating poultry

The plants that were reported as being used for the treatment of poultry ailments are shown in Table 2. Thirty-two plants, representing 20 plant families, were used as ethnoveterinary medicines in the three districts. Most of the plants used in the district for managing poultry health belonged to the Fabaceae followed by Solanaceae family. The most used plant species were the *Aloe* species (74.4%) followed by *Cassia abbreviata* Oliv

Table 2. Ethnoveterinary plants used in poultry health management in drylands; parts of Mwenezi, Chivi and Chiredzi districts of Masvingo province of Zimbabwe.

Family	Scientific name and Voucher number	Vernacular name	Frequency of citation	Diseases/ symptoms treated	Part of plant used	Methods of preparation and administration
Amaryllidaceae	**Allium sativum* L.	**Gariki**	3	Respiratory External parasites	Bulb	Crush and add to drinking water Cut pieces and randomly place in fowl run
Anacardiaceae	*Sclerocarya birrea* (A. Rich) Hochst. subsp. *caffra* (Sond.) Kokwaro (GOBVU V15)	**Mupfura**	1	Respiratory	Bark	Dry, grind and add to drinking water
Apocynaceae	*Carissa spinarum* L. (GOBVU V18)	**Muruguru**	2	General weakness Fowl Pox	Roots	Crush and add to drinking water
Asparagaceae	*Dipcadi longifolium* (Lindl.) Baker (GOBVU V22)	**Chisvosve**	1	Wounds	Stem	Crush and add to drinking water
	Dracaena sp. (GOBVU V6)	**Chikwenga**	1	Wounds	Leaves	Crush and mix with petroleum jelly and apply on wounds
Asphodelaceae	*Aloe aculeata* Pole-Evans (GOBVU V3) *Aloe mawii* Christian (GOBVU V4) *Aloe excelsa* A. Berger	**Gavakava**	201	Eye problems Diarrhea Prevention General weakness Several diseases Respiratory Fowl pox Newcastle Disease (*Chibhubhubhu* in local language) Coccidiosis (*Chitosi* in local language) Wounds Internal parasites shown by worms in poultry feces	Leaves	Crush and add to drinking water Cut pieces and add to drinking water Crush and apply on pox/ wounds Extract sap and apply on wounds/ pox

Asteraceae	*Bidens pilosa* L. (GOBVU V2)	**Mutsine**	2	Diarrhea	Leaves	Give birds to eat the leaves
Chrysobalanaceae	*Parinari curatellifolia* Planch. ex Benth. (GOBVU V24)	**Muchakata**	1	Diarrhea	Bark	Dry, grind and add to drinking water
Combretaceae	*Terminalia sericea* Burch. ex DC. (GOBVU V7)	**Mususu**	7	Diarrhea General weakness Respiratory	Bark Leaves	Boil and give birds to drink Crush and add to drinking water
	Combretum imberbe Wawra (GOBVU V25)	**Mutsviru**	4	Diarrhea	Bark	Crush and add to drinking water
Cucurbitaceae	*Cucumis anguria* L. (GOBVU V5)	**Muchacha**	6	Coccidiosis (*Chitosi*) Diarrhea Respiratory	Fruit	Crush and add to drinking water Cut pieces and add to drinking water
Euphorbiaceae	**Spirostactiys africana* Sond.	**Mutovhoti**	7	General Weakness Newcastle Disease (*Chibhubhubhu*) Appetite booster Respiratory	Bark Leaves	Crush and add to drinking water Dry, grind and add to drinking water
Fabaceae	*Cassia abbreviata* Oliv. (GOBVU V26)	**Murumanyama**	30	Diarrhea Coccidiosis (*Chitosi*) Wounds Newcastle Disease (*Chibhubhubhu*) Respiratory Prevention Several Diseases	Bark Roots Leaves	Crush and add to drinking water Dry bark, grind and add to drinking water Add to drinking water
	**Dalbergia nitidula* Welw. *e*x Baker	**Murima**	3	Newcastle Disease (*Chibhubhubhu*) Fowl Pox	Bark	Dry, grind and add to drinking water Crush and add to drinking water
	Afzelia quanzensis Welw. (GOBVU V16)	**Mukamba**	8	Newcastle Disease (*Chibhubhubhu*) Snake repellent General weakness	Bark	Add to drinking water Place bark in and around fowl runs Dry, grind and add to drinking water

	Pterocarpus angolensis DC.	**Mubvamakovo/ Mubvamaropa**	3	General weakness Newcastle Disease (*Chibhubhubhu*)	Bark	Crush and add to drinking water
	Colophospermum mopane (J.Kirk ex Benth.) J.Léonard (GOBVU V20)	**Mupani/ Mucharu**	2	General weakness	Leaves	Crush and add to drinking water
	Senegalia nigrescens (Oliv.) P.J.H.Hurter (GOBVU V13)	**Munanga**	3	Respiratory Eye problems	Bark	Crush and add to drinking water
	Neorautanenia brachypus (Harms) C.A.Sm.	**Zhombwe**	16	External parasites Respiratory Fowl Pox Prevention Diarrhea Several diseases Coccidiosis (*Chitosi*)	Tuber	Crush and place in fowl runs Cut pieces and place in fowl run Peel outer layer of tuber and put in water Crush and add to drinking water Add water in the tuber and give birds to drink
	Senna obtusifolia (L.) H.S.Irwin & Barneby (GOBVU V10)	**Munyon'o**	2	Diarrhea Coccidiosis (*Chitosi*)	Roots	Crush and add to drinking water
Meliaceae	*Melia azedarach* L. (GOBVU V8)	**Musiringa**	2	Diarrhea	Leaves	Crush and add to drinking water
Myrothamnaceae	*Myrothamnus flabellifolius* Welw.	**Mufandichimuka**	1	Diarrhea Coccidiosis (*Chitosi*) Newcastle Disease (*Chibhubhubhu*)	Roots	Dry, grind and add to drinking water
Olacaceae	*Ximenia americana* L. (GOBVU V12)	**Munhengeni**	16	Diarrhea Respiratory General weakness Prevention Coccidiosis (*Chitosi*) Newcastle Disease (*Chibhubhubhu*)	Roots Leaves	Crush roots/ leaves and add to drinking water Dry, grind and add to drinking water
Rhamnaceae	*Ziziphus mucronata* Willd. (GOBVU V9)	**Muchecheni**	6	Diarrhea Wounds Coccidiosis (*Chitosi*)	Bark	Crush and add to drinking water Dry, grind and add to drinking water

Rubiaceae	*Crossopteryx febrifuga (Afzel. ex G.Don) Benth* (GOBVU V14)	**Mubikasadza**	2	Eye problems	Leaves	Crush and put sap in eyes
Solanaceae	*Capsicum annuum* L. (GOBVU V1)	**Mhiripiri**	20	Diarrhea Internal parasites Coccidiosis (*Chitosi*) Newcastle Disease (*Chibhubhubhu*) Fowl Pox Respiratory	Fruit	Dry, grind and add to drinking water
	Solanum incanum L. (GOBVU V11)	**Nhundurwa**	3	Eye problems Wounds	Fruit	Burn, apply ash in eyes Crush fruit and apply in the eyes Crush and apply on wounds
	Datura stramonium L. (GOBVU V23)	**Zavazava**	2	Wounds	Fruit Leaves	Crush and apply extract on wounds Crush and add to drinking water
	**Nicotiana tabacum* L.	**Fodya**	17	Newcastle Disease (*Chibhubhubhu*) External parasites Diarrhea Respiratory General weakness Prevention Several diseases	Leaves	Dry, grind and add to drinking water Grind and place in fowl runs Crush and add to drinking water
Verbenaceae	*Lippia oatessi* Rolfe (GOBVU V17)	**Zumbani**	7	External parasites Respiratory	Stem	Place stem in fowl runs Crush and add to drinking water. Crush, add to water and broadcast in fowl runs

Vitaceae	*Cissus quadrangularis* L. (GOBVU V21)	**Muvengahonye Murunjurunju**	25	Wounds Fowl pox General weakness Diarrhea Several diseases	Stem	Crush and add to drinking water. Crush and apply on wounds/ pox. Crush and apply sap on pox Crush and add paste on wounds. Rub stem on wounds

***At the time of the survey, samples of these plants could not be found for authentication at the National Herbarium and Botanic Gardens and scientific names were identified using the ZimFlora website (zimbabweflora.co.zw)**

Various *Aloe* species found in Masvingo province including those mostly used for treating poultry diseases are shown in Table 3. *Aloe aculeata* was the most used *Aloe* species as it was ranked first with the highest score followed by *Aloe excelsa*.

Table 3. *Aloe* species mostly used in the study area. The rank was obtained after participatory scoring was done in focus group discussions (FGD). The most used *Aloe* species with the highest score was ranked first

	MWENEZI		**CHIVI**		**CHIREDZI**			
***Aloe* species**	FGD 1	FGD 2	FGD 3	FGD 4	FGD 5	FGD 6	**Total score**	**Rank**
Aloe chabaudii var. mlanjeana Christian	0	0	0	0	1	1	2	7th
Aloe aculeata Pole-Evans	4	3	5	4	3	4	23	1st
Aloe excelsa A. Berger	3	2	3	2	4	2	16	2nd
Aloe zebrina Baker	2	1	3	3	1	2	12	4th
Aloe greatheadii var. davyana (Schönland) Glen & D.S.Hardy	3	2	3	4	0	3	15	3rd
Aloe parvibracteata Schönland	1	2	1	0	2	0	6	5th
Aloe globuligemma Pole-Evans	0	1	0	0	1	1	2	7th
Aloe tauri L.C.Leach	1	1	0	0	1	0	3	6th

* Key: Scores in the table indicate ranks given to different *Aloe* species based on which are most used. Highest number (five) for the *Aloe* species which was mostly used in treating poultry and the lowest number (one) for the least used *Aloe* species. 0 was for the *Aloe* species which was not used in treating poultry diseases.

Informant consensus factor for poultry diseases

Respiratory diseases had the highest FiC (0.87) followed by diarrhea (0.86). Snake bites and loss of appetite had the least FiC of 0.

Table 4. Informant consensus (FiC) factors of the poultry ailments

Disease category	**Informant Consensus Factor (FiC)**
Respiratory diseases	0.87
Diarrhea	0.86
Newcastle Disease	0.85
Fowl pox	0.85
Internal parasites	0.83
General weakness	0.82
External parasites	0.82
Wounds	0.81
Several diseases	0.81
Prevention	0.73
Coccidiosis	0.67
Eye problems	0.50
Snake bites	0
Loss of appetite	0

Parts of plants used for preparing herbal remedies

Leaves (89%) were the most used part of plant for treating poultry ailments followed by bark (24%) while tubers (7%) were the least used plant parts as shown in Figure 4.

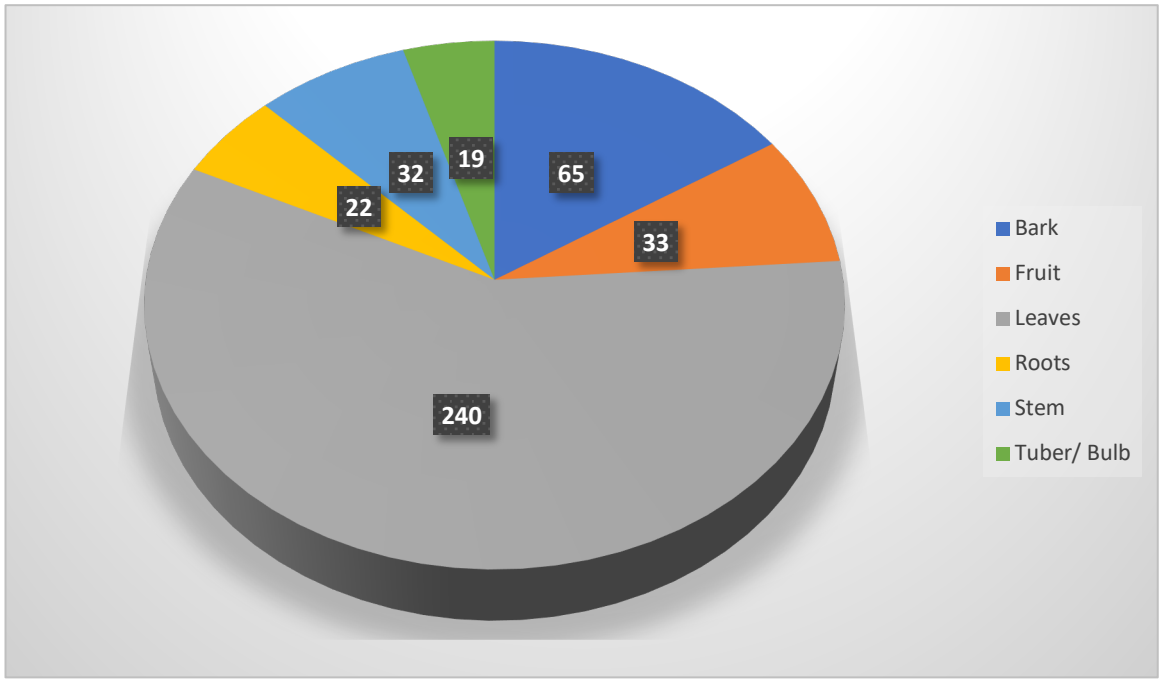

Figure 4. Parts of plants used for treating poultry ailments. The frequency is expressed as the number of respondents that mentioned using a part of a plant.

Methods of preparing herbal remedies

Crushing was the common method of preparing herbal remedies for treating poultry and was mentioned by 81% of the respondents followed by grinding (20%) as shown in Figure 5.

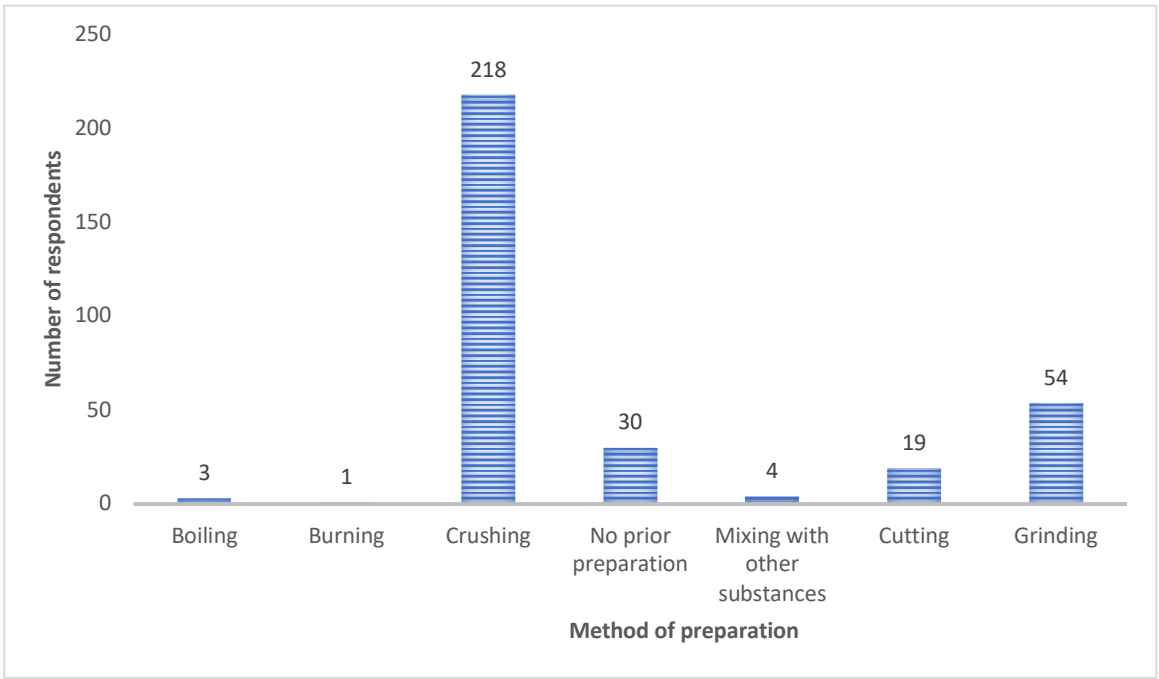

Figure 5. Various methods used for preparing herbal medicines. The frequency is expressed as the percentage of respondents that mentioned a particular method of preparation.

Problems reported as being associated with the use of medicinal plants in treating poultry

Problems that were reported as being associated with the use of medicinal plants in treating poultry are shown in Figure 6. Most of the respondents reported that they did not face any problems (64%) in using ethnoveterinary plants while the least mentioned problem was difficulties in accessing of some plants (2.6%).

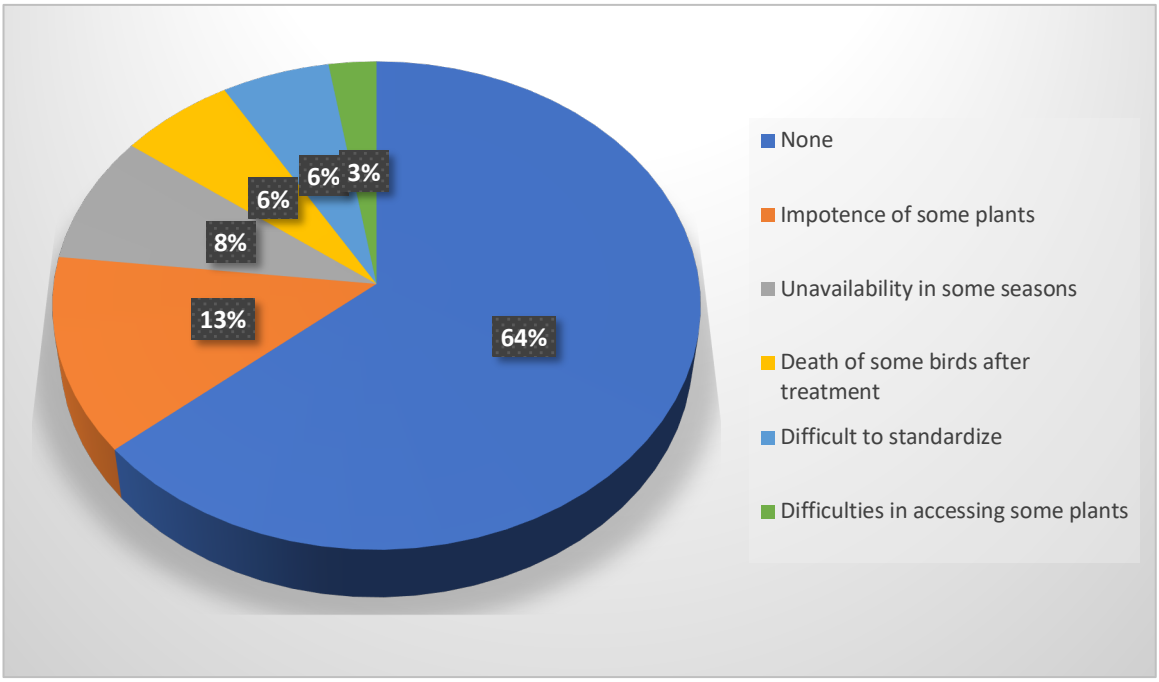

Figure 6. Problems reported as being associated with the use of medicinal plants in treating poultry. The frequency is expressed as the percentage of respondents that mentioned a particular problem or lack of problems.

Reasons why farmers use medicinal plants to treat poultry diseases

As shown in Table 5, the farmers used ethnoveterinary medicines to treat poultry diseases mainly because of their accessibility (44.4%) and affordability (32.6%). Other reasons for the use of medicinal plants in poultry health included their ease of use, having no side effects and that veterinary extension services provided by the government were limited.

Table 5: Reasons why respondents use medicinal plants to treat poultry diseases. The frequency is expressed as the percentage of respondents that mentioned a particular reason.

Reason	Frequency (%)
Accessibility	44.4
Affordability	32.6
Easy to use	27.1
No side effects	13.0
Limited veterinary extension services	0.4

Threats to expansion of ethnoveterinary medicines

Table 6 shows various factors that were mentioned by respondents as affecting the growth and expansion of different medicinal plants used for treating poultry diseases. Climate change and deforestation (29.6%) were identified as the major threats to the growth and expansion of the herbal plants followed by veld fires (16.7%). The least mentioned threat was termites (0.7%).

Table 6. The threats to the expansion and growth of medicinal plants as mentioned by respondents from surveys. The frequency is expressed as the percentage of the respondents that mentioned each threat.

Threat	Frequency (%)
Climate change	29.6
Deforestation	29.6
Veld fires	16.7
None	13.0

Livestock and wildlife movement and foraging	4.8
Competition with human medicine	4.1
Termites	0.7

Information on medicinal plants

Medicinal plants were obtained mainly from the wild (62.6%). Some of the respondents harvested some of the medicinal plants from the home and garden (12.2%) while others harvested from both the wild and home (25.2%). Most of the medicinal plants used were available all year round (86.3%) while others were available only in summer (8.2%) and winter (5.5%). The leaves of deciduous plants were not available for preparing remedies during winter. The major source of ethnoveterinary information on plants and plant parts used along with methods of preparing and remedies and diseases treated was from the elders (54.1), other villagers (23.7%) and extension workers (19.6%).

Discussion

Demographic information

Most respondents were female (62.2%) and this can be attributed to the fact that males usually migrate to urban centres for work while women remain as household heads. Women play a major role in the production of poultry in rural areas and are generally the main owners and managers of poultry (Gueye 2000). The most common age group of the respondents was 40 to 49 years (26.7%) and this is to that reported by Maroyi (2012); Nyahangare et al. (2015); Jambwa *et al*. (2021). Shen *et al*. (2010) agree with current results on that older villagers were more likely to know traditional health management methods than all others. Schunko *et al*. (2012) highlight that age has a positive relation with local medicinal knowledge and that higher education is found to reduce ethnoveterinary knowledge. There was no significant difference in knowledge of EVM between young and middle-aged people from the current study and this indicates that ethnoveterinary knowledge is still being passed on through its application in the daily practice of livestock raising.

Information on poultry

The fact that indigenous breeds of chickens were the most reared type of poultry (96.3%) was also reported for; Mushagashe area by Mwale *et al*. (2005), Gutu district by Masimba *et al*. (2011), Bindura, Murehwa and Chipinge by Jambwa *et al*. (2021). This may be related to the resistance to disease and relative ease of management of the indigenous chickens. Layers are kept by five of the local farmers as most remote communities cannot access improved feeds, veterinary drugs, and quick markets to sustain intensive production and as such resort to indigenous chicken production. The rearing system preserves scavenge-based rural chickens in the context of local culture, indigenous knowledge, time, resources of family producers, and the social perception of families (Kamoyo & Guta 2021). Rural farmers benefit most from extensive poultry production systems since the birds are allowed to roam freely and require minimal farmer involvement. Despite new technologies, the broad or free-range technique of raising chickens has survived in the tropics (Ovwigho *et al*. 2009).

Poultry diseases common in the study area

The high FiC for respiratory diseases (0.87), diarrhea (0.86), fowl pox (0.85) and Newcastle disease (0.85) is an indication that most of the respondents agreed on medicinal plants used in the management of the diseases. The current research findings indicate that the local people showed a tendency to use the same medicinal plants, and this can be an indicator of the genuine therapeutic value of these medicinal plants. Since the study areas were in the same province, their geographical proximity creates opportunity for the exchange of information regarding plant resources utilized as ethnoveterinary remedies for different ailments. Knowledge exchange has benefited from geographic and cross-cultural connections (Gobvu *et al*. 2023). Snake bites and loss of appetite, however, had an FiC of zero indicating a high intracultural variation on the medicinal plants that are used in managing the ailments.

Diarrhea being the most problematic disease (46.7%) in the current study can be due to the fact that it is caused by different factors, which include overindulgence, heat stress, coccidiosis, toxic ingestion, worms, viruses amongst others. Diarrhea comes in different forms in poultry, which the local farmers may fail to separate, and they include white diarrhea, brown diarrhea, green diarrhea and diarrhea with blood spots. Respiratory diseases are a common threat in smallholder poultry producers as the diseases can easily spread due to poor management and lack of knowledge on prevention measures. Poultry houses in rural areas are usually very small leading to birds overcrowding, increased dust levels, high ammonia rates and high humidity which increase the chances of disease spread. Respiratory diseases are often multifactorial and may require laboratory investigation to reach a specific diagnosis and this is currently available in the rural areas.

Ethnoveterinary plants used for treating poultry

The herbal plants used were from 20 families indicating that the area consists of considerable diversity of plant species. Most of the medicinal plants used belonged to the Fabaceae family and this agrees with results from a previous study by Jambwa *et al*. (2021). Plants from Fabaceae family are utilized as supplies of traditional remedies, food, wood, garden ornaments, fibers, dyes, fuels, gums, and pesticides (Maroyi 2023). The Fabaceae family regularly contain alkaloids, which have a wide range of pharmacological activities, and this leads to their broad use in ethnoveterinary (Ahmad *et al*. 2016). Most of the Fabaceae plants that were used for treating poultry diseases are trees except for, the tuber *Neorautanenia brachypus*. *Colophospermum mopane* was the least vulnerable as only the leaves are used for herbal remedies.

Aloe species were the most common used plant species (74.4%) in treating poultry. Previous studies in Zimbabwe on ethnoveterinary health management of poultry reported the use of various *Aloe* species, which include *Aloe greathedii, Aloe chabaudii*, *Aloe vera* and *Aloe spicata* in treating poultry diseases (Mwale *et al*. 2005; Masimba *et al*. 2011; Maroyi 2012; Gumbochuma *et al*. 2013; Jambwa *et al*. 2021). Other studies done in Botswana and South Africa reported the use of *Aloe* species in poultry health management (Moreki 2012; Ndlovu *et al*. 2023). Despite *Aloe chabaudii* being the commonest of aloes, which occur in the lowveld (Kimberley 1974), it was still not ranked the best for use in treating poultry. *Aloe aculeata*, which was ranked the most used in treating poultry is almost as widespread as *Aloe chabaudii* and the two are frequently found growing together. This study becomes the first to mention the use of *Aloe aculeata* and *Lippia oatessi* in the management of poultry health. These findings can be attributed to the potency of the plants and also their availability in the study area(s).

Parts of plants used for preparing herbal remedies

The common part of plants which was used for treating poultry was leaves (88.9%) followed by bark (24.1%). Previous studies in Zimbabwe and beyond have indicated the common use of leaves in ethnoveterinary health management (Nyahangare *et al*. 2015; Eiki *et al*. 2022). Most secondary metabolites produced by plants are synthesized in leaves, which are also a rich source of chemically active substances (Yeshi *et al*. 2022). Since their uncontrolled harvesting frequently poses serious conservation issues for the life of the plant, the use of plant parts like bark and roots may not be sustainable over time. To ensure ethical harvesting methods and the long-term survival of these priceless woody plants, deliberate measures are necessary (Selogwate *et al*. 2021). The use of roots, bark and tubers may hinder expansion and growth of EVM. *N. brachypus*, which can have a large tuber, is most likely to be unsustainably harvested.

Methods of preparing herbal remedies

The most use method of herbal preparation was crushing (81%). Modes of recipe preparation largely depend on the type of targeted medicinal plant, parts of plants employed, type of disease and the livestock types being treated and may be related to long-term experiences of farmers on methods with best preforming ethnoveterinary regimens (Oda *et al*. 2024). When preparing remedies, farmers usually prefer methods that are simple and that use simple equipment. Various plant components are often crushed or ground in mortar and pestles constructed of stone or wood (Yirga *et al*. 2012). Probably due to its availability or the fact that the active ingredients found in the majority of plants are water soluble (Kurian *et al*. 2021), water was the most commonly employed diluent in the production of remedies.

Reasons why farmers use medicinal plants to treat diseases

The use of traditional health management because of its accessibility (44.4%), affordability (32.6%), ease of use (27.1%) and having no side effects (13.0%) agrees with results from a study done in Ethiopia by Temeche & Asnakew (2020). Ethnoveterinary medicines compared to pharmaceuticals are culturally appropriate and sustainable as they are readily available to farmers (Bakare *et al*. 2020). Significance of EVM is paramount in arid and semi-arid areas such as Masvingo province, as livestock provide major food security in times of crop failure because livestock tend to be more resilient than crops when disasters such as drought strike. Thus, EVM could play a vital role in such areas to improve livestock health ensuring household food security and income generation options.

Problems associated with the use of medicinal plants in treating poultry

Problems that were documented in the current study as faced by respondents when using EVM were also similar to those mentioned in previous studies by Marandure (2016) and Temeche & Asnakew (2020). Some birds die after being treated using EVM and this is attributed to lack of precise dosages, which could lead to toxicity (Gobvu *et al*. 2024). Medicinal plants could be poisonous due to substance accumulation or overdose. Therefore, shortcomings of ethnoveterinary practices are toxicity or inefficacy and lack of standardization that should be validated through pharmacological properties studies with

toxicity investigations (Oda *et al*. 2024). Some herbs are available only in certain seasons and this limits the use of EVMs (Eshetu *et al*. 2015). Some herbal treatments which use fruits, for example, from *Solanum incanum* and *Datura stramonium* can only be prepared during seasons when they are available. It is therefore advisable that we promote the growing of such plants in home gardens to ensure their availability and use throughout the year.

Information on medicinal plants

Most of the plants used in treating poultry diseases in the current study were sourced from the wild (62.6%). The use of wild medicinal plants shows the level of anthropogenic pressure placed on wild plant resources and is causing biodiversity loss and may reduce future options to get natural medicines (Parveen *et al*. 2020). Promoting the cultivation of medicinal plants from home and garden has major advantages which include biodiversity conservation since some medicinal plants are at risk due to habitat loss and over-harvesting. Aloe species are an example that can be home-grown because they are at risk of both loss of habitat and overharvesting; of which they are slow to regenerate. The major source of ethnoveterinary knowledge according to responses from this study was from elders, followed by other villagers and extension officers. The fact that extension officers are now sharing information on EVM is a major highlight in the promotion of their use and taking advantage of their benefits for improved production of poultry.

Threats to the expansion of ethnoveterinary medicines

Climate change and deforestation (29.6%) were identified as the major threats to the growth and expansion of the herbal plants followed by veld fires (16.7%). One of the study sites; Chizvirizvi; in Chiredzi district is a resettlement area. The major threats to medicinal flora are anthropogenic disturbances and ecological degradation, which include expansion of farmlands, overgrazing, deforestation and soil erosion. The passage of time has seen the people of Chizvirizvi becoming increasingly concerned about congestion and environmental degradation in the resettlement scheme, as the five-hectare arable plots were not sufficient for most households to grow enough food (Chigonda & Chazireni 2018). Most natural land areas have been encroached by inhabitants and converted to agricultural lands and that has led to decline in the multipurpose and medicinal plants in the district. Medicinal plants have been highly affected by overgrazing from both livestock and wildlife as the resettlement area is bordered by Malilangwe wildlife reserve to the west. The animals freely graze and thus reduce the regeneration ability of medicinal plants.

Mudzengi *et al*. (2014) claims that since most ethnoveterinary medicines are natural products, they are hence threatened by the drivers of biodiversity loss, which include habitat change, climate change (Brown *et al*. 2012; Chafa *et al*. 2021), overexploitation, droughts, and invasive species. The main effects of climate change on medicinal plants are changes in geographical limits, changes in crop yields, and impacts on the production system (El Gendy *et al*. 2023). According to a study in Ethiopia by Temeche & Asnakew (2020); environmental degradation, agricultural expansion, forests and woodlands degradation, fire, cultivation of marginal lands, overgrazing and urbanization appear to be the major threats to the expansion of ethnoveterinary medicines. Efforts are needed to propagate and cultivate those plants at most risk, for example, *N. brachypus* tuber, which is being exploited for human and livestock medicine while at the same time being used for feeding cattle during the dry season. *In-situ* and *ex-situ* conservation measures have been undertaken around the world to protect medicinal plants from further damage. *In-situ* conservation is the conservation of species in their natural habitat. Some medicinal plants have to be conserved *in-situ* due to difficulty for domestication and management (Mir *et al*. 2021).

Conclusion

A catalogue of twelve poultry ailments was developed and diarrhea was the most problematic disease in the study area(s) (46.7%). Thirty-two plants from 20 different families were used to treat poultry ailments. *Aloe*, locally referred as *gavakava* were the most used plant genus for treating diseases that affect poultry. *Aloe aculeata* was the most used of the *Aloe* species. This study becomes the first to report the use of *Aloe aculeata* and *Lippia oatessi* as ethnoveterinary medicines for poultry health management. The use of these plants can be due to their effectiveness and also their accessibility in drylands. Documentation of indigenous knowledge is important in preserving traditional knowledge of plants used for treating poultry ailments in drylands of Zimbabwe. There is need for scientific validation of some of the plants that are used to manage poultry health through phytochemical analyses and antimicrobial assays. There is need for the conservation and protection of such plants from being overused and extinction.

Declarations

***List of abbreviations*:** EVM: Ethnoveterinary medicine; FiC: Informant consensus; FGD: Focus group discussion; NR: Natural Region; cm: centimetres

Ethics approval and consent to participate: The study was approved by the Medical Research Council of Zimbabwe (MRCZ/A/3079). Permission was sought from the District Administrators, (DA), councillors and village heads to enter in the communities and collect data. Informed consent was also sought from the households by asking verbal consent of the household head.

Consent for publication: Not applicable

Availability of data and materials: The authors confirm that the data supporting the findings of this study are available within the article.

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