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Knowledge and use of Ethno-Veterinary Medicines by Smallholder Farmers in Control Helminths in Beef Cattle in Matebeleland South, Zimbabwe

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Abstract: A structured questionnaire survey was conducted to determine the knowledge and use ethno-veterinary medicines by smallholder farmers. The study aims to determine the knowledge and use of traditional remedies by smallholder farmers to control helminths in beef cattle in Matebeleland South province, Zimbabwe.Findings on the study revealed that 52% use Ethno-veterinary medicines, 48% do not. The local people use six plant species belonging to five families as ethno-veterinary remedies. Three plant families were particularly frequent in usage: Ebenaceae, Caricaceae and Fabaceae while the most utilized plant species were *Diospyros mespiliformis* 26%, *Carica papaya* 23%, *Dichrostachys cinerea* 19%, *Khaya senegalensis* 19%, *Viscum album 10%* and *Pterpcarpus angolensis* 3%. Three common cattle gastrointestinal worms were identified in the surveyed area. The major and most common cattle gastrointestinal worms were strongyle, monezia and coccidia. The most frequently used plant parts were barks (62%), then leaves (24%), then stem (10%) and lastly roots (3%) D*ichrostachys cinerea* showed highest efficacy in strongyle, *Carica papaya* in monezia and *Diospyros mespiliformis* in coccidia. These ethno-veterinary plants were used not only as alternatives to conventional veterinary anthelminths but also because in certain helminths they were thought to be more efficacious.

Keywords: *Anthelminthic Activity, Ethno-Veterinary Medicines, Helminth Infections, Efficacy, Ruminant Productivity.*

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I. INTRODUCTION

Conventional antihelminth are mainly used in the control of helminths, however, their efficacy is diminishing due to increased resistance in helminths population. The study aims to determine the knowledge and use of traditional remedies by small holder farmers to control helminths in Beef cattle in Matebeleland South province, Zimbabwe. In recent years, there has been a growing interest in the use of Ethno-veterinary medicines (EVMs) as an alternative or complementary approach in controlling helminths in beef cattle (McCarthy et al., 2017). Helminthiasis result in substantial economic losses due to reduced productivity, decreased meat production and increased mortality rates (Charlier et al., 2014). Conventional anthelminthic treatments are widely used to control helminths but their effectiveness is threatened by the development of resistance, residue accumulation in animal products and environmental pollution (Waller et al., 2014).

Ethno-veterinary medicinal practices which involve use of different plant species have been used to cotrol helminths in beef cattle. Several plants with anthelminthic properties that can potentially be integrated into cattle management practices have been identified. Traditional herbal medicines have been found to be effective against a range of internal parasites (Ranasinghe et al., 2023). These ethno-veterinary plants offer numerous benefits including easily accessiblele,

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cost-effectiveness and environmentally sustainability compared to conventional alternatives. In addition socio-cultural acceptances of these Ethno-veterinary plants by these small holder farmers plays a critical role in their utilization and adoption. Medicinal plants have emerged as promising candidates for controlling helminth infections due to their pharmacotherapeutic potential, minimal toxicity, and low environmental impact (Hamid et al., 2023). Knowledge and practices of farmers regarding ethno-veterinary medicines for helminth control will be assessed, commonly used ethno-veterinary medicinal plants used for managing helminths in beef cattle will be identified, methods of plant collection and identification used by farmers will be documented.

The study also aims to test the efficacy of selected EVMs in reducing helminth egg counts in beef cattle (McCarthy et al., 2017) and identify the most effective EVMs and their dosages for controlling helminths in beef cattle (Kumar et al., 2017). The ultimate goal is to identify alternative, sustainable, climate smart and environmental friendly control methods.

II. METHODOLOGY

➢ *Study Site*

The study was carried out in Insiza and Matobo districts Matabeleland south province, Zimbabwe. It is in Natural region IV and receives 450mm-600mm of rainfall annually, with periodic seasonal droughts and severe dry spells during the rainy season. Matobo and Insiza districts are suitable for semi extensive farming, with small scale farmers relying on livestock farming and rain fed crop production. The soils in the district are predominantly sandy and sand loamy with low organic matter content and poor water holding capacity, resulting in water shortages during the dry season. Livestock farming is the main source of income for many farmers in the two districts with cattle and goats being the predominant species. These livestock species are kept in extensive grazing systems with limited veterinary care and poor sanitation predisposing them to helminths infestation. The animals often graze on pastures that are contaminated with eggs of helminths which they ingest. Livestock production is the most appropriate due to low and variable rainfall which restricts the potential for cropping. However, farmers grow mainly maize, sorghum and millet on large proportions of the land. 60 respondents with 47 males and 13 females with different age groups, educational levels, livestock herd size from the 2 districts.

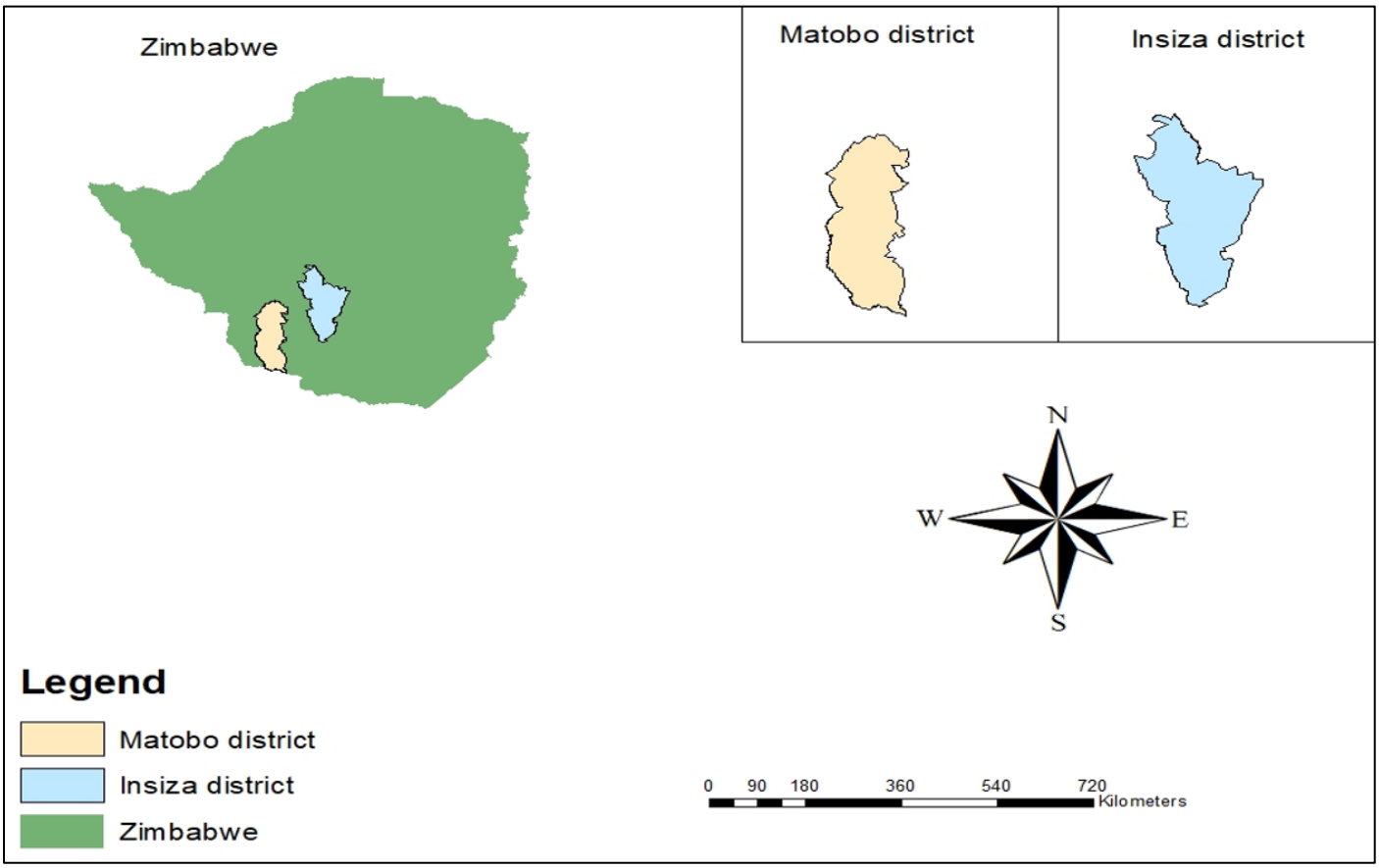

Fig 1 Map of Zimbabwe Showing Insiza and Matobo Districts where the Study was Conducted.

➢ *Sampling Techniques*

60 respondents from the 2 districts were selected, quota sampling was used with proportional allocation targeting 30 Insiza and 30 Matobo farmers respectively. Quota sampling ensures that specific sub-groups (in this case, farmers from each district) are equally represented in the sample (Etikan et al., 2016). Equal distribution among the districts ensures a balanced representation of the two districts accounting for

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similar cattle management practices and agro-ecological weather. Farmers were identified using available livestock ownership lists with the help of village heads, Agric. Extension officers and Livestock development committees within each ward.

➢ *Data Collection*

A structured questionnaire was used during data collection noting the local plants' names, parts used, growth habit, modes of preparation, dosages and administration. The study involved personal observations, interviews of herdsmen, herbalists and farmers. One hundred and fifty small holder farmers in Insiza and Matobo districts were interviewed to ascertain their knowledge and use of traditional remedies to control helminths in cattle and goats. Structured interviews about medicinal plant use in controlling helminths in livestock were conducted. The survey allowed for the collection of sociodemographic data (gender, age, educational level) and traditional knowledge about medicinal plants and their uses in controlling helminths in livestock. Prior informed consent will be obtained. In addition, farmers will be asked to provide data about their operations: i) pastures – size and possibility of rotations, ii) size and composition of cattle herds, iii) frequency of anthelmintic treatment, treatment strategy, choice of drugs, and knowledge about anthelmintic resistance, iv) perceptions, use and knowledge about traditional remedies for controlling helminths. Data were summarized into major themes by content analysis such as percentages, rate, and frequencies computed using Microsoft Excel (2007) package.The variation in knowledge and use of EVMs with gender, age, and level of education was analysed using a logistic regression model and visualized using multiple correspondence analysis (MCA) in R (version 3.5.3) (R Core Team 2014), furthermore the identified EVMs plants will be tested to check its efficacy.

➢ *Data Analysis*

Data obtained were analyzed using logistic Rstudio version 3.5.3, Chi-squared, and Pearson's Chi-squared test were also used to test significance differences in common Ethno-veterinary medicines plants used.

III. RESULTS AND DISCUSSION

Table 1 Demographic Distribution of the Study Farmers

Characteristic	**Female (22%)**				**Male (78%)**			
Age (Years)	21 - 40	41 -60	>61	**Total**	21 - 40	41- 60	>61	**Total**
	3	5	5	13	10	28	9	47
Livestock ownership								
Livestock	**Number of livestock**		**Percentage (%)**		**Number of livestock**		**Percentage (%)**	
Cattle	191		16.4		973		83.6	
Goats	149		14.5		879		85.5	
Sheep	35		38.5		56		61.5	
Poultry	257		19.1		1089		80.9	

➢ *Household Demography Distribution*

Gender distribution consists of 78.3% males and 21.7% females. Males have the largest number of livestock owning 80.9% whilst females own 19.1% of the total livestock. It has noted that culturally males are the owners of livestock and few widows and female headed families do own less livestock.

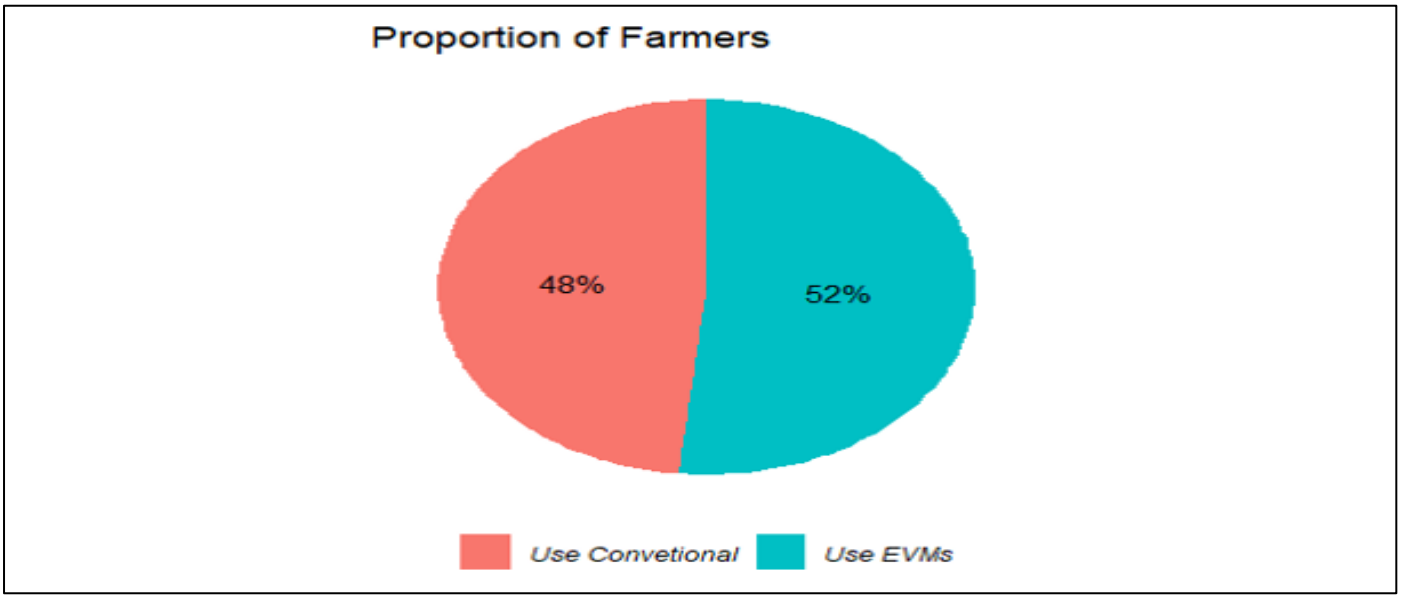

Fig 2 Proportion of Farmers

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The analysis revealed that Ethno-veterinary medicines are more preferred by small holder farmers in Insiza and Matobo respectively, showing 52% whilst conventional antihelminth less preferred showing 48%. There are certain factors contributing these variables such as affordability, accessibility, cultural beliefs, trust of the traditional knowledge and proved efficacy.

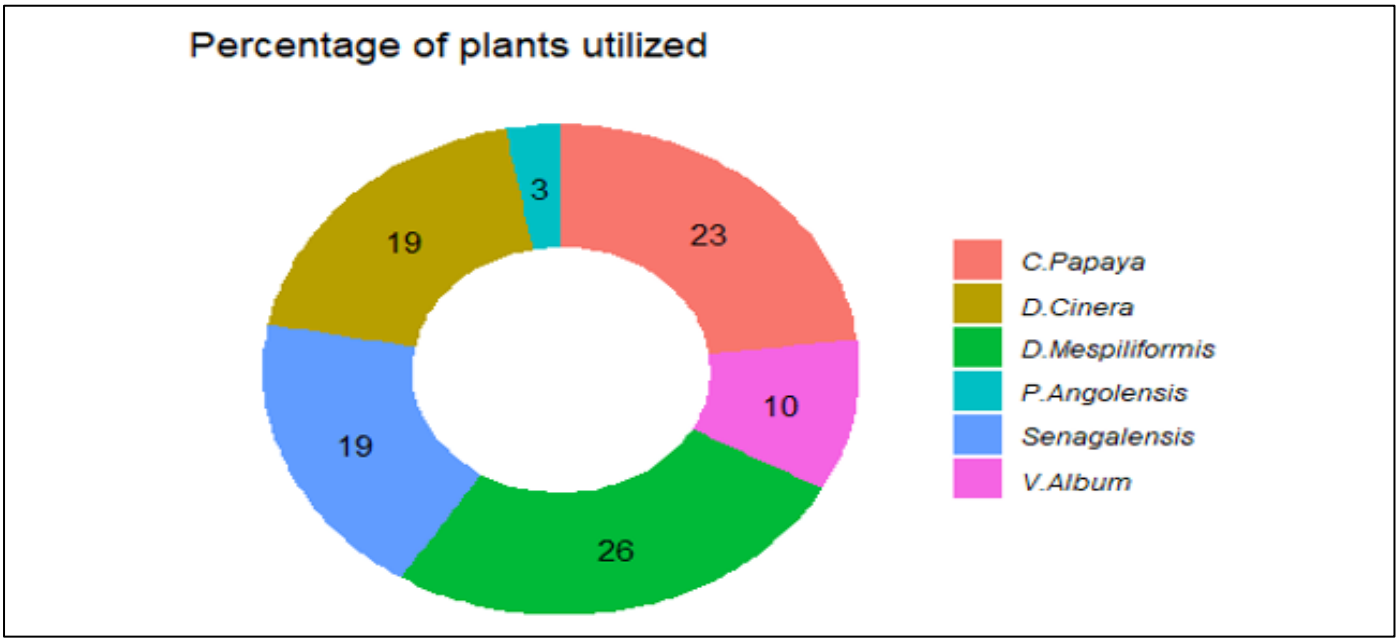

Fig 3 Percentage of Plants Utilized

Six plant species were identified to be used by small holder beef cattle farmers in Insiza and Matobo districts respectively in control of helminths, however their usage differs in all these species. Among the six species *Dichrostachys cinerea (26%)and Carica papaya* (23%) are more frequently used by these smallholder farmers, moderate plants species in use *Diospyros mespiliformis (19%), Diospyros senegalense (19%)* and less frequently used plant species *Viscum album (10%)* and *Pterocarpus angolensis.* These variables are mainly determined by accessibility, known or peceived eficacy and probably mode of preparation.

Bark is the frequently used plant part (62%), followed by leaves (24%), then leaves and stem (10%) lastly roots with (3%) these preferences are determined by the concentration of active compounds. Farmers indicated that barks have anthelmintic, antimicrobial and inflammatory properties which are required in control of helminths that is why is it more preferred. Harvesting techniques of the plant parts is key for sustainability.

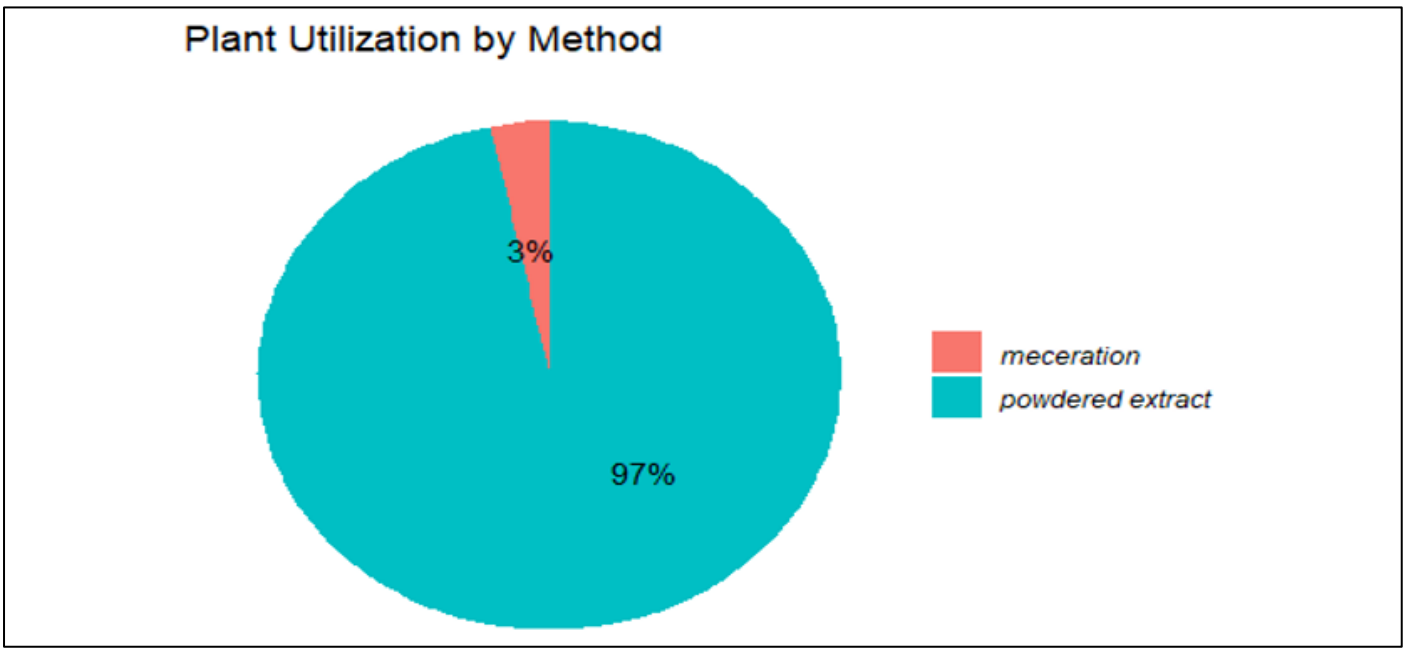

Fig 4 Plant Utilization by Method

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The pie chart indicates that majority of farmers (97%) use powdered extract. Farmers highlighted that powdered extracts are more prefered by farmers because they have long life span, easy to prepare, hand and high concentration. On dosage powder can be measured easily and proper dosages administered. Farmers often dry plant material under sunlight and pound it using traditional tools, making the method highly accessible without need for specialized equipment (Gakuya et al., 2013). The low adoption (3%) on meceratyion noted on the study. Maceration demands clean water or solvent availability, which may not be consistently accessible in semi-arid regions like Matabeleland South (Ndlovu et al., 2021), however macerated products have very short life span and prone to spoilage.

Table 2 Plant Efficacy Distribution

Result type	Plant	High efficacy	Moderate efficacy	Low efficacy
F strongle	C. papaya	31%	25%	100%
	D. cinerea	25%	50%	0%
	D. mespiliformis	44%	25%	0%
M Monezia	C. papaya	30%	100%	0%
	D. cinerea	30%	0%	0%
	D. mespiliformis	40%	0%	0%
Coccidia	C. papaya	33%	0%	0%
	D. cinerea	29%	0%	0%
	D. mespiliformis	38%	0%	0%

Chi-squared test for given probabilities: Coccidia: X-squared= 0.28571

Pearson's Chi-squared test: Monezia: X-squared= 2.1, df = 2, p-value = 0.3499

Pearson's Chi-squared test: Strongyle = 3.1328, df = 4, p-value = 0.5359

The study revealed plant efficacy distribution following fecal egg count. *D. mespiliformis* showed highest efficacy (44%), followed by *C. papaya* (31%) and lastly *D. cinerea* (25%) in control of Strongle. On Monezia *D. mespiliformis* (40%) sowed highest efficacy followed by *C. papaya* and *D. cinerea* having the same percentage efficacy. On coccidia *D. mespiliformis* (38%) showed the highest efficacy followed by *C. papaya* (33%) the lastly (29%) *D. cinerea*. The resutlts indicates that *D. mespiliformis* is the broad spectrum anthelminth showing the highest efficacy in all the gastrointerstinal parasites. *C. papaya* and *D. cinerea* demonstrates value and merits, however its phytochemical profiling to isolate their anthelmintic constituents gave moderate to high efficacy.

Table 3 Ethno-Veterinary Medicinal Plants used to Treat Helminthiosis in Ruminants, Local Name Plant Parts used, Preparation, Dosage and Mode of Admnistration

Scientific name	Family name	Local name	PPU	MOP	Preparation	Dosage & admnistration	%age use by Farmers
Diospyros mespiliformis	*Ebenaceae*	Umdlawuzo	B	P	Powder: dried bark and ground bark steeped in water at the ratio 1:2 for 2 hours drench cattle	1-2ml/kg body weight	25.8%
Dichrostachys Cinerea	*Fabaceae*	Ugagu	B	P	Powder: dried and ground barks steeped in water mixed at 1:5	1-2 litres per animal depending on the size and age.	19.4%
Carica papaya	*caricaceae*	Papaya	L	P	Dry, grind leaves then mix with the solvent to create a concentrated extract	10-20ml per 100kg body weight	22.6%
Pterocarpus angolensis	*Fabaceae*	Umvagazi	R	M	Dry roots steeped in water	10-20 ml/100kg body weight for 3-5 days	3.2%
Khaya senegalensis	*Meliaceae*		B	P	Bark is dried and ground into a powder then mixed with water to create a medicinal drink	20-30ml/100kg body weight twice a day for 3-5 days	19.4%
Viscum album	*Santalaceae*	Igumalala	L + S	P	cut, dry and grid into powder	5-10ml/100kg body weight for 3-5 days	9.7%

PPU - Plant Part used, **MOP –** Method of Preparation, **R** – Roots, **L** – Leaves, **S –** Stem, **P –** Powdered Extract, **M** – Maceration, **D –** Decoction

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Table 4 Summary of Plant Parts used by Farmers in the Control and Management of Helminths

Plant parts	Number	%age number of plants
Bark	**14**	25.8%
Bark	**11**	19.4%
Leaves	**13**	22.6%
Roots	**2**	3.2%
Bark	**11**	19.4%
Leaves and Stem	**9**	9.7%

IV. CONCLUSION

This research aimed to determine the knowledge and use of Ethno-veterinary medicines in control of helminths in beef cattle by smallholder farmers in Insiza and Matobo district Matabeleland south province, Zimbabwe Research from the Madikwe area highlights the rich ethnoveterinary knowledge among local communities, emphasizing the importance of preserving and transferring this knowledge to younger generations for sustainable livestock management (Merwe et al., 2001) The majority of farmers in Matabeleland south province demonstrated significant indigenous knowledge of ethno-veterinary medicines used as anthelminths in control gastrointestinal helminths. There are three most commonly identified ethno-veterinary medicinal plants included *Diospyros mespiliformis*, *Dichrostachys cinerea*, and *Carica papaya*.

These ethno-veterinary medicinal plants were administered as powdered extracts through oral drenching and this reflected deep-rooted traditional practices. Scientific evaluation of efficacy revealed that *D. mespiliformis* had the highest anthelmintic potential, with 44% of farmers reporting high efficacy against strongyle infections, consistent with studies that report its phytochemical richness in tannins and flavonoids (Mugambi et al., 2021; Ncube et al., 2019). *D. cinerea* exhibited moderate efficacy (50%), while *C. papaya* showed the lowest anthelmintic effectiveness for nematode control, though it remains effective for protozoan infections such as coccidiosis (Madzimure et al., 2020).

These results demonstrate that smallholder farmers are not only custodians of indigenous knowledge systems but also active experimenters and evaluators of therapeutic outcomes. However, limitations in standardization, dosage control, and phytochemical variability remain challenges to optimal efficacy. These findings underscore the need for further pharmacological validation, dosage standardization, and integration of EVMs into formal animal healthcare systems. It has been noted that strengthening this knowledge through scientific research, extension services, and policy inclusion can enhance sustainable livestock health and support One Health goals.

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