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Research Article

Ethnoveterinary Knowledge of the Fulani Community in Benin on Ethnobotanical Remedies for Gastrointestinal Parasites in Cattle and Chickens

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Abstract | Gastrointestinal parasites represent a major constraint to livestock production in northern Benin, where Fulani communities rely on long-standing ethnoveterinary practices based on medicinal plants. This study aimed to document endogenous strategies used to manage digestive parasites in cattle and chickens, assess the perceived effectiveness of the plants employed, and identify opportunities for strengthening these practices. A multifaceted approach was used, including the development of an interactive mapping model of the study areas, focus group discussions, and individual interviews with 240 Fulani farmers to collect ethnobotanical information, followed by an assessment of the plants identified by users. A total of 50 plant species from 25 families were recorded for cattle and 25 species from 15 families for chickens, some of which occur in ecologically sensitive areas and include taxa threatened with extinction. The species reported as most effective correspond to those most frequently cited by respondents as effective in treating gastrointestinal parasites. For cattle, *Khaya senegalensis* was cited by 73% of respondents, followed by *Anogeissus leiocarpa* (55%), and *Crossopteryx febrifuga* (53%). for chickens, *Khaya senegalensis* was cited by 67.5% of respondents, followed by *Parkia biglobosa* (62%), and *Azadirachta indica* (57%). The findings highlight the depth of Fulani ethnoveterinary knowledge and underline the need to document, promote, and strengthen these medicinal plant-based practices. To this end, their integration into a scientific validation framework is essential, particularly through phytochemical screening of the species used, as well as the implementation of *in vitro* and *in vivo* biological assays. Such an approach will enable the evaluation of efficacy, safety, and mechanisms of action of traditional remedies, while contributing to their valorization and long-term sustainability.

Keywords | Anthelmintic, Fulani livestock farmers, Herbal medicines, Ethnoveterinary, Endogenous strategies, Fulani ethnoveterinary knowledge

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INTRODUCTION

In tropical Africa, particularly within rural communities, the use of ethnobotanical resources for healthcare is a practice that is deeply entrenched in tradition. In Benin, in extensive pastoral areas, rural livestock farmers employ this practice as a preventive and curative measure for gastrointestinal parasitic diseases, representing an alternative to the numerous conventional treatments that are often financially inaccessible and sporadically unavailable in rural areas. The risk of parasites is known to exacerbate in intensive system of livestock farming where animal density is continuously high than other livestock system. In this case, helminthiasis manifests clinically with the symptoms that affects health in cattle; while in poultry, coccidiosis is the most significant parasitic disease worldwide (Montout, 2023; Raynaud *et al*., 1974). In northern Benin, this situation poses a significant challenge to animal health and has a direct impact on livestock productivity, food security, and, almost crucially, the livelihoods of livestock farmers (Magassouba *et al*., 2007). Furthermore, there is documented evidence that certain botanical resources possess anthelmintic properties. However, this knowledge is being lost over generations. Within the spectrum of diverse ethnic groups, the domain of veterinary ethnomedicine applied to cattle is recognised as a particular expertise of the Fulani community (Bâ, 1994; Mathias-Mundy and McCorkle, 1989; Tamboura *et al*., 1998).

In Benin, the superiority of the Fulani ethnic group in terms of botanical knowledge in traditional veterinary medicine applied mainly to cattle has been confirmed in comparison to other ethnic groups, including the Adja, Bariba, Dendi, Fon, Ottamari, Yoa-Lokpa and Yoruba (Dassou *et al*., 2015). According to this study, the Fulani community has a wealth of knowledge about the medicinal properties of plants, including their applications and the diseases they can treat. Consequently, the Fulani people are regarded as the primary sources of knowledge for traditional veterinary ethnopharmacology.

The objective of the present study was to acquire documentation of alternative practices to modern medicine for the management of cattle and chicken digestive parasitic diseases among disadvantaged populations so that the preservation of indigenous knowledge was ensured. The study, conducted in the departments of Borgou and Alibori (located in northern Benin), was undertaken in three distinct phases. The initial phase of the study entailed the mapping of medicinal ethnobotanical resources within the designated study areas. The subsequent phase involved the execution of focused group discussions, while the final phase encompassed the administration of individual surveys. A rigorous and multifaceted methodology was used to gather valuable information on traditional practices for managing parasitic diseases, while contributing to the documentation and preservation of ancestral knowledge.

MATERIALS AND METHODS

Study environment

This study was conducted in two departments of Benin, mainly in the municipalities of Tchaourou, Parakou, and N'dali (Borgou county) and in the municipality of Gogounou (*Alibori county*). The study municipalities are situated within two distinct agroecological zones, corresponding to the cotton-producing areas of northern and central Benin (Figure 1). The climate in this region is tropical, with a pronounced dry season extending from November to May and a rainy season occurring between June and September.

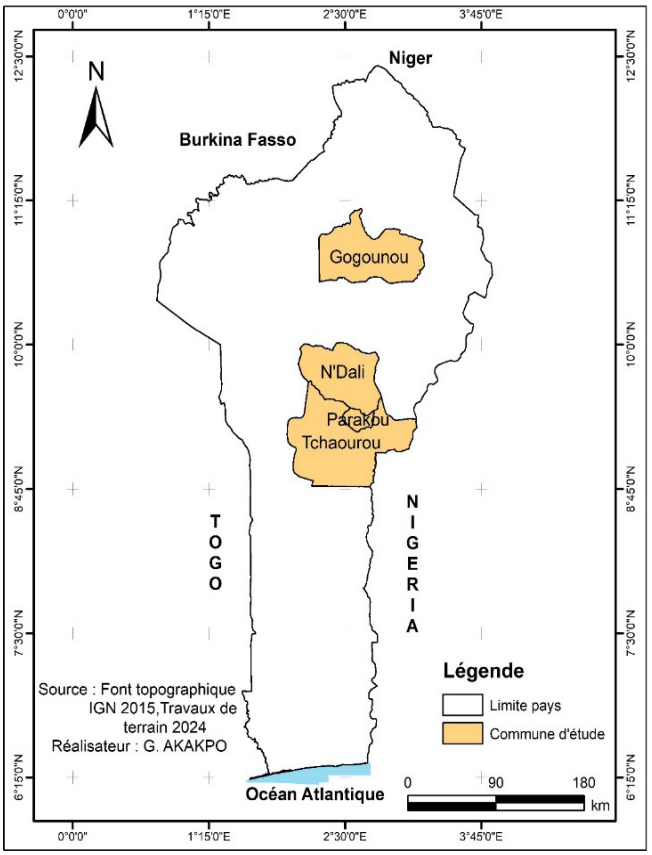

Figure 1: Map showing the areas in which the study was conducted.

Materials

A tablecloth was used to represent the surface of the study area, and sculpted pieces were employed to illustrate the main environmental components. A digital camera was used for photographic documentation, and newspaper sheets were utilized for the preparation of herbarium specimens of the inventoried plants.

Methodology

Study design

The study was carried out in five sequential phases: (i) construction of interactive models, (ii) focus group discussions, (iii) ethnobotanical surveys, (iv) taxonomic identification, and (v) participatory prioritization of ethnobotanical resources.

Interactive model

Interactive models were developed for each study site following the guidelines of Larzilière *et al*. (2013). A total of 120 stakeholders (60 per municipality; 30 per village) participated, including livestock and agro-livestock farmers. Participant recruitment was conducted in collaboration with the National Association of Professional Ruminant Breeders' Organizations (ANOPER) and the Territorial Agency for Agricultural Development (ATDA). The activity was conducted from 14 to 18 October 2024.

Focus group discussions

Focus group discussions were organized from 9 to 18 December 2024, applying ethnobiological data collection techniques as described by (Albuquerque *et al*., 2014). These discussions were designed to document local knowledge and practices regarding the use of plants in the management of digestive parasitic diseases.

Ethnobotanical survey

Semi-structured interviews were conducted with all targeted participants between 6 and 10 April 2025 in order to collect information on respondents' profiles, their knowledge of digestive parasites in cattle and poultry, and ethnobotanical recipes used for parasite control. Prior to each interview, the objectives of the study as well as the exclusively scientific use of the data collected were clearly explained to the participants, and their free and informed consent was obtained. Participation in the study was voluntary. A non-random snowball sampling strategy (Houéhanou *et al*., 2016) was applied. With the assistance of ANOPER (National Association of Professional Organizations of Ruminant Breeders) and ATDA (Territorial Agency for Agricultural Development), an initial key informant was identified, after which referrals were used until no new participants could be identified.

Taxonomic identification

Plant species cited during the ethnobotanical survey were validated through field visits with local guides and experienced farmers (Albuquerque *et al*., 2014). Specimens were collected, preserved, and deposited at the National Herbarium of Benin, where taxonomic authentication was performed using the Analytical Flora of Benin (Akoègninou *et al*., 2006).

Participatory prioritization

Frequently cited plants and those with reported anthelmintic activity were subjected to participatory prioritization by community members from 1 to 6 June 2025. Evaluations were conducted by the scoring method in groups at the village level, considering two criteria: (i) availability (based on seasonal accessibility) and (ii) perceived effectiveness. Scores were compiled for each plant, and rankings were established accordingly.

Data analysis

Data from individual surveys and group discussions were entered, organized, and analyzed using Microsoft Excel software. The analysis relied exclusively on descriptive statistics. Respondents sociodemographic characteristics were summarized using frequencies and percentages. Similarly, clinical signs associated with gastrointestinal parasitic infections in cattle and poultry, as perceived by farmers, were described in terms of citation frequency.

Plant species used in the traditional treatment of gastrointestinal parasitic infections were analyzed using ethnobotanical indices, namely the relative frequency of citation (Fr) and use value (VUe), in order to identify the plants most commonly used by local communities.

$$Fr = n/N * 100$$

Where; n= number of informants who cited the species and N total number of informants interviewed; N= total number of informants interviewed.

$$Vue = \sum Ui / N$$

Where; Ui = number of ethnoveterinary uses of the species mentioned by informant i; ∑Ui = total number of uses cited for the species; N = total number of informants.

Plant use according to animal species (cattle and poultry), the plant parts employed (bark, leaves, roots, and other organs), and the methods of remedy preparation were examined descriptively.

RESULTS

Interactive model

The interactive community models showed that botanical resources were randomly distributed across village territories, including forests, fields, and settlements (Figure 2). However, surveys of local communities highlighted a marked decline in the availability of plant species traditionally used in the management of gastrointestinal parasitic diseases. While these resources were previously abundant and readily accessible, they are now reported as

increasingly scarce, raising concerns about their long-term sustainability and potential risk of extinction.

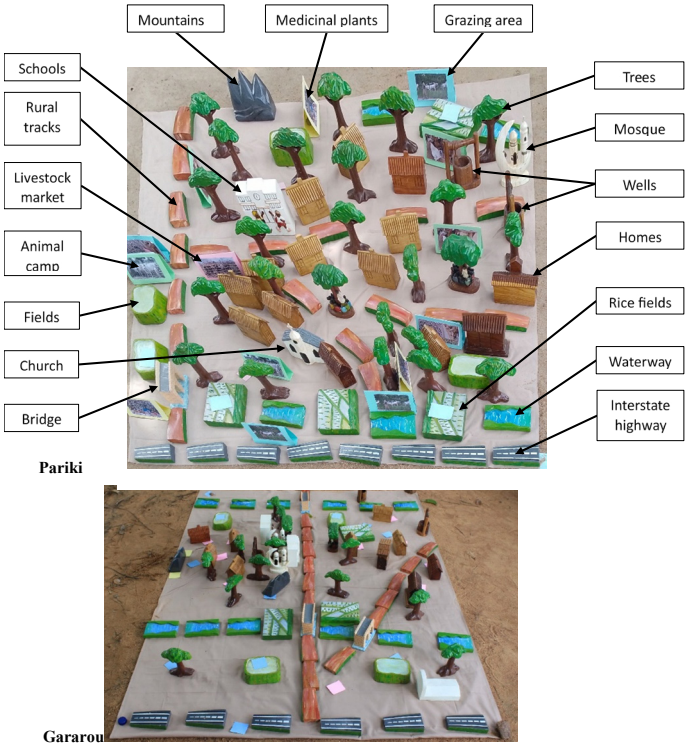

Figure 2: Participatory representation showing the image in December 2024 of two villages (Gararou in the municipality of Tchaourou and Pariki in the municipality of Gogounou).

Discussion with farmers on traditional methods of controlling digestive parasites

Group interviews with livestock farmers on gastrointestinal parasite infestations and ethnoveterinary practices revealed substantial community knowledge regarding the diagnosis of digestive parasitic diseases and the plants used for their treatment. These discussions led to the identification of 144 participants for individual interviews. Analysis of sociodemographic characteristics of respondents showed that most participants (88%) had only basic literacy, while 12% had received formal education and just 1% had attended university. The sample was ethnically homogeneous, composed exclusively of Fulani community. Livestock farming was predominantly mixed (cattle and poultry), and the majority of respondents (90%) were adults over 30 years of age (Table 1).

Recognition of gastrointestinal parasites in cattle and poultry

Farmers reported a wide range of external clinical signs they considered associated with gastrointestinal parasite infestations, although perceptions varied among individuals. In cattle, weakness, weight loss, and anemia were consistently identified as the most reliable indicators of infestation, whereas in poultry, diarrhea followed by weakness was most frequently cited (Figure 3).

Table 1: Sociodemographic characteristics of respondents.

Variables	Terms and conditions	Effectif	%
Level of education of actors	Literacy	58	40
	None	69	48
	Primary	12	8
	Secondary	4	3
	University	1	1
Ethnicity	Peulh	100	100
Species raised	Cattle	11	6
	Cattle and Chickens	132	92
	Chickens	1	1
Age groups	15-30	15	10
	30-50	76	53
	50 and over	53	37
Religions	Christianity	39	27
	Islam	105	73

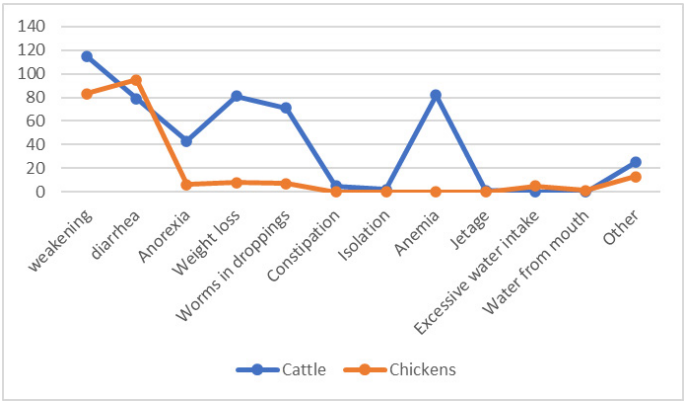

Figure 3: Frequency of signs indicating infestation in cattle and chickens among farmers

Traditional practices for combating digestive parasitic infections

Several botanical species with presumed anthelmintic properties were identified as part of traditional practices for the control of gastrointestinal parasitic infections (Table 2). These plants constitute an essential component of local ethnoveterinary knowledge and represent potential candidates for further pharmacological validation and sustainable livestock health management.

Use of plants in traditional cattle and chicken care

Results show that farmers possess greater ethnoveterinary knowledge of botanical resources for cattle than for poultry in the management of digestive parasites. In practice, bark is the most frequently used plant part in antiparasitic treatments, followed by leaves and roots, whereas other organs are rarely employed (Figure 4).

Table 2: Medicinal plant species used in ethnoveterinary practices by Fulani herders for cattle and poultry, considered to possess probable anthelmintic activity (including plant parts used and preparation methods).

Familes	Scientific Name	Local name Peulh	FC cattle	FC poultry	Part used	Target animal species	Usage practices	Duration of use
Combretaceae	*Anogeissus leiocarpa* (DC.) Guill. and Perr.	Abangahi	0	1	Bark	Cattle	Pounded with salt	Frequently
						Chicken	Maceration	
Liliaceae	*Allium sativum* L.	Ayu	0	3	Fruit/Root	Chicken	Maceration	Frequently
Anacardiaceae	*Anacardium occidentale* L.	Akajuhi	1	6	Bark	Cattle	Health food	1/day*3
						Chicken	Maceration	Frequently
Polygalaceae	*Securidaca longepedunculata* Fresen.	Alalo	0	2	Root	Chicken	Maceration	Frequently
Fabaceae	*Burkea africana* Hook.	Aragerahi	1	0	Bark	Cattle	Infusion	1/day*3
Combretaceae	*Pteleopsis suberosa* Engl. and Diels	Kurukuraawo	4	4	Bark	Chicken	Maceration with potash	Frequently
Rubiaceae	*Sarcocephalus latifolius* (Sm.) EABruce	Bakurehi	2	0	Root/ Leaves	Cattle	Infusion	1/day*2
Fabaceae	*Pericopsis laxiflora* (Benth. ex Baker) Meeuwen	Balebale	1	0	Root	Cattle	Infusion	1/day*3
Fabaceae	*Pterocarpus erinaceus* Fougère-Vill.	Banuhi	12	0	Bark	Cattle	Pounded with salt/Infusion	1/day*3
Fabaceae	*Piliostigma thonningii* (Schumach.) Milne-Redh.	Barakehi	2	2	Leaves	Cattle	Grinding	1/day*7
					Root	Chicken	Maceration	Frequently
Phyllanthaceae	*Bridelia ferruginea* Benth.	Bembemkuhi	2	0	Bark	Cattle	Maceration	1/day*7
Malvaceaea	*Sterculia stipulata* var. stipulée	Bokpoli	1	0	Bark	Cattle	Infusion	1/day*3
Lamiaceae	*Ocimum gratissimum* Forssk.	Bumbunoowa	0	2	Leaves	Chicken	Grinding	Frequently
Rubiaceae	*Crossopteryx febrifuga* (Afzel. ex G.Don) Benth.	Burdebehi	0	9	Bark	Cattle	Pounded with salt	Frequently
Rutaceae	*Citrus limon* (L.) Osbeck	Leemuhi	1	2	Leaves	Cattle	Grinding	2/Month
					Fruit	Chicken		
Rubiaceae	*Gardénia ternifolia* Schumach. and Thonn.	Digaali	1	0	Root	Cattle	Infusion	1/day*3
Bixaceae	*Cochlospermum parvifolium* Planch.	Jaruuji	1	0	Leaves	Cattle	Maceration	1/day*3
Combretaceae	*Terminalia avicennioides* Guill. and Perr.	Dooki	3	0	Root/Bark/ Leaves	Cattle	Infusion	Frequently
Annonaceae	*Annona senegalensis* Pers.	Dukuhi	1	1	Root/ Bark	Cattle	Infusion	1/day*7
						Chicken	Maceration	
Fabaceae	*Albizia glaberrima* (Schumach. and Thonn.) Benth.	Esowanuhi	1	0	Leaves	Cattle	Pounded with salt	Frequently
Apocynaceae	*Calotropis procera* (Aiton) Dryand.	Bambamki	1	0	Root	Cattle	Infusion	1/day*3
Rubiaceae	*Sarcocephalus latifolius* (Sm.) EABruce	Gararowa	1	0	Root	Cattle	Infusion	2/day
Chrysobalanaceae	*Maranthes polyandra* (Benth.) Prance	Gorojehi	2	0	Bark	Cattle	Pounded with salt	Frequently
Combretaceae	*Guiera senegalensis* JFGmel.	Gelokehi	3	0	Leaves	Cattle	Pounded with salt	Frequently
Bignoniaceae	*Kigelia africana* (Lam.) Benth.	Jillijallahi	7	0	Bark	Cattle	Infusion/Pounded with salt	1/day*3

Table continued on next page.....

Familes	Scientific Name	Local name Peulh	FC cattle	FC poultry	Part used	Target animal species	Usage practices	Duration of use
Meliaceae	*Khaya senegalensis* (Desv.) A. Juss.	Kahi	111	52	Root	Cattle	Maceration	1/ Week *4
Meliaceae	*Pseudocedrela kotschyi* (Schweinf.)	Harerehi	16	1	Bark	Cattle	Pounded with salt	3/Month
						Chicken	Infusion/ Maceration	Frequently
Solanaceae	*Datura gigantea* Huber	kom	2	0	Seed	Chicken	Maceration	Frequently
Fabaceae	*Daniellia oliveri* (Rolfe) Clapier. and Dalziel	Kallahi	12	0	Bark	Cattle	Pounded with salt	Frequently
						Chicken	Maceration	Frequently
Sapotaceae	*Vitellaria paradoxa* CFGaertn	Kaarehi	2	0	Bark	Cattle	Pounded with salt	Frequently
Combretaceae	*Anogeissus leiocarpa* (DC.) Guill. and Perr.	Kojoli	4	0	Root/Bark	Cattle	Pounded with salt	1/day*7
					Leaves	Chicken	Maceration/ Infusion	Frequently
Fabacées	*Prosopis africana* (Guill. and Perr.) Taub.	Kohan	3	0	Bark	Cattle	Pounded with salt/ Infusion	4/Month
Fabaceae	*Detarium microcarpum* Guill. and Perr.	Konkehi	5	0	Seed	Cattle	Maceration	1/day*3
						Chicken		
Rubiaceae	*Mitragyna inermis* (Willd.) Kuntze	Kooli	2	10	Root/Bark/ Leaves	Cattle	Pounded with salt	1/day*3
					Bark	Chicken	Maceration/ Infusion	Frequently
Anacardiaceae	*Mangifera indica* L.	Mangohi	6	0	Leaves	Cattle	Grinding	Frequently
Moringaceae	*Moringa oleifera* Lam.	Moringa	0	1	Bark	Cattle	Pounded with salt/Infusion	3/Month
Mimosaceae	*Parkia biglobosa* Benth.	Narehi	0	1	Leaves	Chicken	Grinding	Frequently
Meliaceae	*Azadirachta indica* A.Juss.	Korobuhi	3	6	Bark	Cattle	Maceration	3/Month
						Chicken		
Sapotaceae	*Mimusops kummel* Bruce ex A.DC.	Nyelbehi	8	0	Leaves	Chicken	Grinding/ Maceration	Frequently
Euphorbiaceae	*Sapium grahamii* Prain	Pampale	0	1	Bark	Cattle	Infusion	3/ Week
Caricaceae	*Carica papaya* L.	Karabosi	0	1	Leaves	Chicken	Maceration	Frequently
Fabaceae	*Dichrostachys cinerea* R.Vig.	Pattulehi	5	0	Leaves	Chicken	Grinding	Frequently
Solanaceae	*Capsicum annuum* L.	Nyeekuhi	2	5	Root/Bark/ Leaves	Cattle	Pounded with salt/ Infusion	Frequently
Moraceae	*Ficus sur* Forssk.	Rimata-bec-cehi	9	0	Leaves/ Fruit	Cattle	Grinding	Frequently
						Chicken	Maceration	
Rubiaceae	*Crossopteryx febrifuga* (Afzel. ex G.Don) Benth.	Rimatajigahi	6	0	Root/Bark/ Seed	Cattle	Pounded with salt	Frequently
Palmeae	*Borassus aethiopum* Mart.	Bandorahi	1	0	Bark	Cattle	Pounded with salt	Frequently
Opiliaceae	*Opilia amentacea* Wall.	Sakakokowa	6	0	Bark	Cattle	Pounded with salt	3/Month
Euphorbiaceae	Euphorbe unispina NEBr.	Sesera	0	1	Fruit	Chicken	Maceration	Frequently
Fabaceae	*Pericopsis laxiflora* (Benth. ex Baker) Meeuwen	Sorokuhi	8	13	Stem/ Bark	Cattle	Maceration	Frequently
						Chicken		
Opiliaceae	Opilia amentacea Wall.	Sukasukawri	1	0	Leaves/ Bark	Cattle	Pounded with salt	Frequently
Poaceae	*Imperata cylindrica* (L.) Raeusch.	Soyore	3	0	Leaves	Cattle	Pounded with salt	Frequently

Table continued on next page.....

Familes	Scientific Name	Local name Peulh	FC cattle	FC poultry	Part used	Target animal species	Usage practices	Duration of use
Solanaceae	*Nicotiana tabacum* L.	Taba	2	10	Leaves	Cattle	Grinding	1/day*3
Anacardiaceae	*Lannea acida* A.Rich.	Cami	1	1	Leaves	Cattle	Maceration	Frequently
						Chicken	Infusion	
Annonaceae	*Hexalobus monopetalus* (A.Rich.) Engl. and Diels	Tibakihi	1	1	Bark	Cattle	Maceration	Frequently
						Chicken		
Combretaceae	*Terminalia laxiflora* Engl.	Stemrehi	3	0	Bark	Cattle	Pounded with salt/Infusion	Frequently
Asteraceae	Vernonia amygdalina	Tuwawo	2	2	Leaves	Cattle	Pounded with salt	1/day*3
Myrtaceae	*Eucalyptus globulus* Labill.	Turare	1	0	Root	Cattle	Infusion	1/day*7
Fabaceae	*Afzelia africana* Sm.	Warnyahi	5	0	Root/Bark/ Leaves	Cattle	Infusion/ Maceration	1/day*3
Fabaceae	*Cajanus cajan* (L.) Huth	Otiili	2	2	Leaves	Cattle	Infusion/ Grinding	Frequently
						Chicken	Maceration	
Combretaceae	*Guiera senegalensis* JFGmel.	Yoloko	0	1	Leaves	Chicken	Grinding	Frequently
Loranthaceae	*Agelanthus dodonaeifolius* (DC.) Polhill and Wiens	Soto-karehi	1	0	Bark	Cattle	Infusion	Frequently

NB: FC Cattle: Frequency of citation of the plant for treating cattle; FC Poultry: Frequency of citation of the plant for treating poultry.

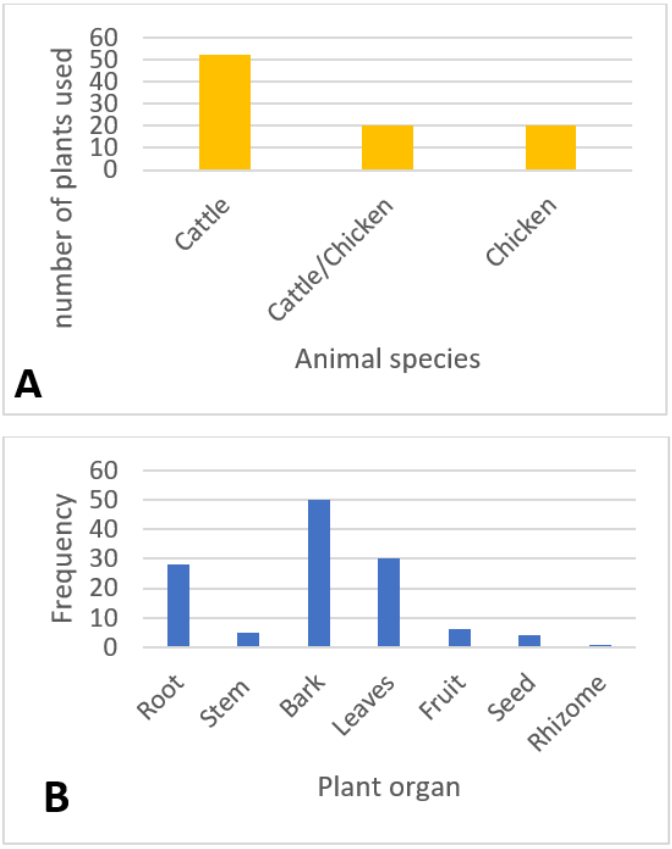

Figure 4: Number of plants cited for the treatment of each animal species (A) and frequency of use of each plant organ in care (B).

Recipe preparation techniques

For cattle, the most common preparation methods are infusion and crushing of plants mixed with salt before administration. In contrast, for poultry, maceration and subsequent grinding predominate (Figure 5).

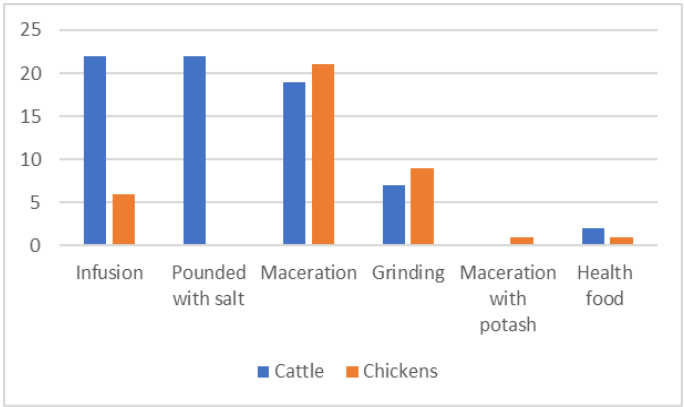

Figure 5: Recipe preparation method.

Evaluation of plants used in cattle and chickens farming

Among the recorded species, the availability and perceived effectiveness of the most frequently cited plants were evaluated based on citation frequency by local stakeholders (Tables 3 and 4). Considering these two criteria, *Khaya senegalensis* (Desv.) *A.Juss*, *Anogeissus leiocarpa* (DC.) Guill. and Perr, and *Azadirachta indica* A.Juss emerged as the most relevant species for cattle, while *Khaya senegalensis*, *Parkia biglobosa* Benth, and *Capsicum annuum* L. were identified as the most pertinent for poultry, each obtaining a score ≥10/20.

Table 3: Results of the participatory assessment of the availability and perceived effectiveness of plants used to control digestive parasites in cattle by Fulani communities using the scoring method

Plants	Availability of the plant			Perceived effectiveness of the plant			OA
	Tchaourou	Gogounou	Average	Tchaourou	Gogounou	Average	
Khaya senegalensis	10.50	11.20	10.85	17.80	18.70	18.25	14.55
Bridelia ferruginea	8.30	1.05	4.68	14.40	3.95	9.18	6.93
Pseudocedrela kotschyi	5.90	3.60	4.75	15.30	17.00	16.15	10.45
Detarium microcarpum	5.90	10.25	8.08	4.40	10.35	7.38	7.73
Azadirachta indica	8.45	11.15	9.80	10.85	12.25	11.55	10.68
Maranthes polyandra	6.30	7.55	6.93	6.55	13.55	10.05	8.49
Crossopteryx febrifuga	8.80	9.50	9.15	8.25	15.85	12.05	10.60
Anogeissus leiocarpa	12.85	10.90	11.88	13.95	9.35	11.65	11.76
Pteleopsis suberosa	3.35	0.00	1.68	5.00	0.00	2.50	2.09
Kigelia africana	4.25	3.05	3.65	14.10	13.70	13.90	8.78
Vitellaria paradoxa	7.85	5.00	6.43	4.60	7.05	5.83	6.13

NB: OA = Overall Average.

Table 4: Results of the participatory assessment of the availability and perceived effectiveness of plants used to control digestive parasites in chickens by Fulani communities using the scoring method

Plants	Availability of the plant			Perceived effectiveness of the plant			OA
	Tchaourou	Gogounou	Average	Tchaourou	Gogounou	Average	
Khaya senegalensis	10.50	11.20	10.85	15.40	16.90	16.15	13.50
Euphorbia unispina	3.60	1.95	2.78	12.50	8.00	10.25	6.51
Pterocarpus erinaceus	5.40	5.20	5.30	2.60	10.85	6.73	6.01
Datura officinal	4.40	3.55	3.98	7.40	9.10	8.25	6.11
Nicotiana tabacum	7.90	2.15	5.03	11.90	9.25	10.58	7.80
Detarium microcarpum	5.90	10.25	8.08	4.40	13.50	8.95	8.51
Anacardium occidentale	15.75	9.10	12.43	9.45	8.00	8.73	10.58
Azadirachta indica	8.45	11.15	9.80	11.60	11.20	11.40	10.60
Parkia biglobosa	11.95	13.25	12.60	8.45	15.85	12.15	12.38
Capsicum annuum	8.15	10.05	9.10	12.60	15.15	13.88	11.49
Vitellaria paradoxa	6.25	8.60	7.43	8.65	8.25	8.45	7.94

NB: OA = Overall Average.

DISCUSSION

The surveyed community's sociodemographic profile mirrors that of traditional livestock farmers in the region, which could affect how ethnoveterinary knowledge is preserved and passed on. Village models revealed not only the availability but also the spatial distribution of medicinal plants used against gastrointestinal parasites. The interactive approach underscored a progressive scarcity of these resources, raising concerns about long-term extinction risks. This trend could be associated with agricultural expansion (cotton, yam), intensive livestock systems in northern Benin, uncontrolled logging, bush fires, and non-timber forest exploitation (Agbahungba *et al*., 2001). Their scattered distribution and the absence of domestication strategies further hinder conservation, although household gardens remain a promising option (Batcho *et al*., 2023; Sidi *et al*., 2017).

In traditional, low-input livestock production systems, empirical knowledge constitutes a key component in the diagnosis and management of parasitic diseases. Farmers consistently associated clinical manifestations such as weakness, weight loss, and anemia with parasitic infestations in cattle, observations that align with pathologies typically attributable to strongylosis and *Haemonchus* spp. infections. (Ali and Abdelaziz, 2021; Aouicha and Baroudi, 2021). In poultry, diarrhea and weakness were the predominant indicators, reflecting common *Eimaria* spp. infections (Avi *et al*., 2023). While non-specific, these observations form the practical basis for treatment decisions or veterinary consultation. These findings also reveal gaps in traditional

knowledge for addressing routine challenges from gastrointestinal parasites. They underscore the need to elevate this knowledge on medicinal plants to a new level, necessitating further exploration to build a comprehensive database in Benin.

The ethnoveterinary knowledge base was notably more developed for cattle than for poultry, consistent with the prominent socio-economic role of cattle in Fulani communities (Chabi Toko, 2016). Participatory evaluation confirmed *Khaya senegalensis* as the most prominent species for both species, reflecting its already established antiparasitic activity (Chiezey *et al.*, 2000; Noudèkè *et al.*, 2017; Okpara *et al.*, 2004). Bark and leaves were the most frequently used plant parts, likely due to their accessibility. Similar reliance on bark, leaves, and roots has been documented in other systems for small ruminants (Dassou *et al.*, 2014; Degla *et al.*, 2021; Garba *et al.*, 2019). These results highlight the urgent need for conservation of the most intensively used medicinal species and, above all, emphasize the importance of scientific validation of the documented ethnoveterinary practices. Based on citation frequency, use consensus, and reported therapeutic indications, the most critical next step is the phytochemical screening of the most cited species, followed in order of priority by targeted in vitro bioassays, particularly anthelmintic and antimicrobial assays, and ultimately by controlled in vivo trials on the relevant animal species, with a view to the gradual and sustainable integration of these resources into veterinary practice.

CONCLUSION

This study underscores the pivotal role of veterinary phytotherapy in managing diseases affecting cattle and poultry, while also indicating a decline in the availability of several medicinal plant species, including *Khaya senegalensis,* which is currently subjected to considerable harvesting pressure. Ethnoveterinary knowledge was more developed for cattle, reflecting their socio-economic importance. Urgent actions are needed to conserve these resources, notably through domestication and cultivation, and to validate their pharmacological efficacy for integration into sustainable veterinary practices. In this context, priority domestication and agroforestry programs should focus on highly threatened and frequently cited species such as *Khaya senegalensis*, *Anogeissus leiocarpa*, and *Parkia biglobosa*, in order to ensure their long-term availability while supporting sustainable ethnoveterinary use.

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NOVELTY STATEMENT

This study is novel in that it documents the ethnoveterinary knowledge of the Fulani community in Benin and introduces an interactive mapping of the study localities, providing a realistic view of the availability and distribution of ethnobotanical resources across different zones. Furthermore, the participatory assessment guides the selection of the most effective and environmentally friendly botanical resources for parasite control.

AUTHOR'S CONTRIBUTION

G-CAA, GCA, and DM participated in the design and planning of the work. G-CAA wrote the first draft of the manuscript. GCA, DM, JAD, HF, PKC, GGA, and SH-A participated in the critical revision of the manuscript. All authors have read and approved the submission of this version for publication.

Generative AI and AI-assisted technology statement

The authors confirm that no generative AI or AI-assisted technologies were used in the preparation, writing, or editing of this manuscript.

Conflicts of interest

The authors have declared no conflict of interest.

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