Ethnoveterinary Medicine of the Indigenous people of Odeda Local Government Area, Ogun State, Southwest Nigeria

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ABSTRACT

Livestock population growth and productivity have not kept pace with the increase in human population growth and expansion in Africa. This is due to the prevalence of diseases causing morbidity and mortality in livestock. Conventional veterinary drugs are not readily available to resource-limited rural farmers, hence the need for alternatives. Research on ethnoveterinary medicine (with herbal remedies at the core of therapy), has grown in recent years in a bid to find leads for new bioactive compounds. This study aimed at documenting and validating medicinal plant species and practices used traditionally for different ailments in Ọdédá local government area, Ogun State, Southwest Nigeria. A semi-structured questionnaire and focused group discussions were used to gather data from respondents in 26 villages. Information collected included the plant species and parts used, common/vernacular names of the plants, methods of preparation/administration and toxicity of the plant species. Data on other ethnoveterinary practices employed were also collected. An extensive literature survey was thereafter done to check the veracity of the claims. A total of 24 plant species belonging to 15 plant families were listed. *Lagenaria breviflora* and *Elaeis guineensis* were the plant species with the highest relative frequency of citation. Approximately 90% of the listed plant species were found to have similar ethnoveterinary uses in some other African countries and parts of the world. Approximately 85% of the plants have been reported to be pharmacologically active in the literature surveyed. Lack of proper documentation can lead to loss of the traditional medicinal knowledge and resources threatening the sustainability of rural animal healthcare systems. The integration of ethnoveterinary medicine into orthodox medicine may produce better preventive and therapeutic effects and improve the income of the rural populace in impoverished African countries.

Keywords: medicinal plants; ethnoveterinary medicine; livestock diseases; Ọdédá, Nigeria

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INTRODUCTION

Livestock farming serves a wide variety of purposes; from subsistence to generating employment and income for thousands of smallholder farm households (Njarui et al., 2016). In tropical countries of the world, smallholder farmers own 40% of the national livestock (Keyyu et al., 2003). These farmers face many constraints to their farming activities, the most important being the incidence of various animal diseases causing morbidity and mortality. Due to this, livestock population growth and productivity have not kept pace with the increase in human population growth and expansion in Africa (Okitoi et al., 2007; Adenubi et al., 2016).

In Nigeria, like most tropical countries, rural smallholder farmers have limited access to veterinary services due to poor accessibility to urban areas to purchase conventional veterinary drugs and the exorbitant cost of these drugs (Saganuwan, 2017). Also, the injudicious and extra label use of many conventional veterinary drugs has led to the development of microbial resistance and presence of drug residues in animal by-products (Hollis and Ahmed, 2014; Karam et al., 2016; Ramesh et al., 2018). Thus, many farmers resort to the use of ethnoveterinary medicine for the treatment of their livestock (Musa *et al.*, 2008).

Ethnoveterinary medicine (EVM) refers to the holistic study of indigenous knowledge, skills, practices, beliefs, practitioners and social structures pertaining to the healthcare and husbandry of food, work and income-producing animals. This involves practical development applications within livestock production with the goal of increasing human well-being (McCorkle, 1995). By far the most-studied element of EVM is the use of botanicals (Martin and Mathias-Mundy, 2006). With an estimated 87% of drugs used globally against microbial and parasitic infections being derived from natural products (especially vascular plants), the benefits of EVM in primary animal healthcare are evident (McGaw et al., 2007).

While the use of EVM is common practice in rural farming communities, it is often questioned for its inherent safety, efficacy and validity by Western countries. Since EVM developed mainly through trial and error and rarely through deliberate experimentation for the development of modern drugs, it is viewed as less systematic and less formalized (Katerere and Naidoo, 2010). However, it should be noted that EVM can (1) generate useful information needed to develop livestock healing practices that are suited to the local community (2) be a key veterinary resource for adding useful new drugs to the pharmacopoeia and (3) contribute to conservation of biodiversity (Tabuti et al., 2003).

Nigeria is endowed with a rich flora (Ibekwe and Ameh, 2014). Almost all the vegetation types that exist in other African countries are found widely distributed in different geopolitical zones of Nigeria. The variations in climatic and geographic features of the country favour the growth of approximately 7 895 plant species, making it one of the richest countries in biodiversity in Africa (Nodza et al., 2014). Unfortunately, the large number of medicinal plant species of this diverse vegetation, which can potentially provide templates for the development of useful and safer modern drugs, have not been fully exploited (Adenubi et al., 2018).

Global interest in documenting and validating EVM originated in the early 1980s when people started to realize that EVM is disappearing due to the demise of elderly community members and the advent of modern practices (Jayakumar et al., 2017; Jayakumar et al., 2018). Many rural communities in Nigeria still rely on their traditional health-seeking and healing systems to treat themselves and their animals when disease is encountered. This knowledge is commonly referred to as the strength of the community (Adefolaju, 2014). Ethnoveterinary and human ethnomedicine practices overlap in several parts of the world. These include the types of remedies, the modes of administration of these remedies and the ethnomedical or EVM techniques employed (McCorkle and Martin, 1998; Souto et al., 2011). This overlap may be indicative of the efficacy of these remedies.

In view of the above, proper documentation of the traditional medical knowledge is important to assist discovery of new sources of drugs and to prevent the extinction of this knowledge (Teferi et al., 2009). This study aims to document and validate common indigenous plant species and ethnoveterinary practices used for their therapeutic benefits by smallholder farmers in Ọdédá local government area (LGA), Ogun State, Southwest Nigeria.

MATERIALS AND METHODS

***The study area*:** The study was carried out in Ọdédá LGA of Ogun State with coordinates $7^0$13′N $3^0$31′E (Fig. 1). It is bounded to the North by Ìbàràpá and Ìddó LGAs of Oyo State, to the West by Abẹ́òkúta North and Abẹ́òkúta South LGAs, to the East and South by Ọbáfémi-Owódé LGA (Amori et al*.,* 2013). The LGA is made up of three zones: Ọdédá zone (Ọdédá, Òsíele, Olúga, Olúgbọ́, Baálẹ̀ Ògùn and Ewéjé); Ìlúgùn zone (Ìlúgùn, Olódó, Òkiri-Ojúlé, Aperin, Àkońkò, Olókèméjì and Kugbájàgbé) and Ọ̀pẹ̀jí zone (Ọbańtokò, Ọ̀pẹ̀jí, Àdàó, Alábàtà and Ọbẹ̀tẹ́) (Omoyinmi and Ezeri, 2011). The major rivers in the LGA are Àsàg, Ọtèré and Ọyań rivers (Adelekan*,* 2011).

The study area was purposively selected as the Federal University of Agriculture, Abeokuta (FUNAAB) is in the LGA. The Federal University of Agriculture, Abeokuta, a unique and leading institution, is one of two specialized universities in Nigeria, established on January 1, 1988 with the triple mandate of teaching, research and extension.

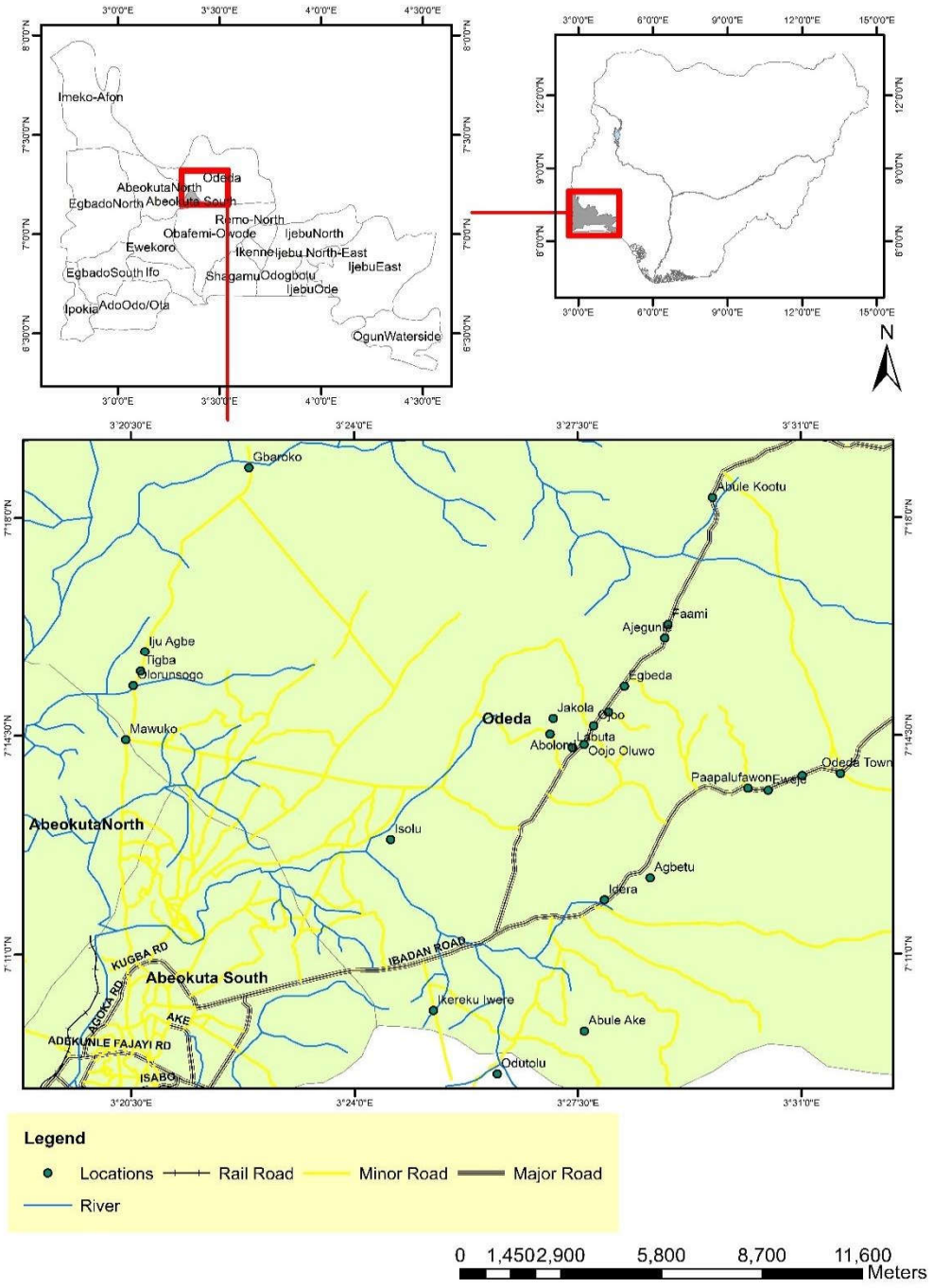

Figure 1: Map showing the villages visited in Ọdédá local government area, Abẹ̀òkúta, Ogun State, Southwest Nigeria

Ọdédá LGA covers an estimated land area of about 1 658 km^2 which represents approximately 1.7% of the total land area of Ogun State (Oguntoke et al., 2010). It is predominantly a rural community with numerous villages spread across the land area**.** The population was estimated at 864 322 people according to the 2006 Nigerian census (Omoare et al., 2015).

The language of the people is Yorùbá (Ègbá dialect) while the non-Yorùbá settlers are the Fulanis, Hausa and Igedes. Farming is the major occupation of the indigenes (Taiwo et al., 2017). Other occupations are trading in farm produce (which is done on periodic market days) and hunting of wild animals (Oguntoke et al., 2010). Ọdédá LGA has a tropical climate with rainfall periods between April and July (with a short dry season in August) and from September to October. The long dry season starts from November to March. The temperature ranges from 20-30^{o}C during the rainy season and from 25-40^{o}C in the dry season. The mean monthly rainfall of the LGA is about 900.3 mm^{3} (Akanni, 1992). The vegetation falls largely within the derived savanna vegetation which generally dominates the northern part of Ogun State. Nevertheless, pockets of forest vegetation which have not been degraded by human activities still exist (Oguntoke et al., 2010).

Research methodology:

A multi-stage sampling procedure was employed to select the study villages. Firstly, 26 villages within a 15 km radius (Northeast, Northwest, Southeast and Southwest) of FUNAAB were selected. The village head ("Baálè") in each of the villages was approached to assist in obtaining prior informed consent from the smallholder farmers, build trust and ease the interview process (Fig. 2). Secondly, smallholder farmers with good traditional knowledge were identified and interviewed from each of the selected villages.

Figure 2: A meeting of the research team, the Area Baálè, Chief Iredele and other chiefs at Olódodo village, Ọdédá local government area, Ogun State, Southwest Nigeria on 13/03/2018

Ethnobotanical survey and data collection

Ethnobotanical surveys conducted in the study area involved the use of participatory epidemiological approaches (interviews, questionnaire and focused group discussions). A validated semi-structured questionnaire was used to obtain information on medicinal plant knowledge and utilization and other ethnoveterinary practices (Awoyomi et al., 2013). Respondents were assured that their responses would remain confidential and would only be used for research purposes.

The interviews were conducted in Yoruba language and voice recording was done (Fig. 3A; 3B). Questions focused on the sociodemographics of the respondents and their knowledge of medicinal plant utilization and other ethnoveterinary practices. Such questions included their sex, age, level of education; origin of knowledge (from parents, learned, others) and main clinical signs treated.

Figure 3A: Focused group discussion of the research team and respondents in Kọ̀ọ̀tù village, Ọdédá local government area, Ogun State, Nigeria on 14/03/2018. B. The research team interviewing a respondent in Abúlé Ọwẹ̀ village, Ọdédá local government area, Ogun State, Nigeria on 21/03/2018

Information on the plant species included name of plant species used, the common/vernacular names of the plant species, parts of plant species used (e.g. roots, leaves, seeds, flowers, stems or others), the methods of preparation (e.g. decoction, infusion, concoction or others), routes of administration (e.g. oral, topical, nasal or others), dosage (frequency and duration of treatment), effectiveness of the herbal remedy and adverse effects observed. Data on other ethnoveterinary practices (aside the use of plants) and folklore beliefs were also collected. Leading questions, jargon and technical terms were avoided when asking the questions.

Sample collection and identification

The listed plant species were collected from the wild by a team comprising the respondents and the research team. Pictures were taken to aid in the identification of the plant species and a photo album prepared. The plant species were identified and authenticated by Prof. Samuel A. Oluwalana, Department of Forestry and Wildlife Management, FUNAAB. Voucher specimens were made and deposited at the Ethno-botanical Survey Herbarium, Nigeria Natural Medicine Development Agency, Lagos State, Nigeria, where each specimen was assigned a specific number.

Literature survey

Further information on the listed plant species was obtained from published journal articles through three scientific databases (Google Scholar, Science Direct and EBSCOhost).

The keywords used for the search were, “medicinal plants”, “phytochemical constituents”, “ethnoveterinary”, “Nigeria”. All documents considered were in English or translated into English. The strength and validity of information obtained from the respondents were evaluated based on similar ethnoveterinary claims in the literature or evidence of phytochemical or pharmacological studies that support the claims.

Data analysis

The data about the uses of the listed plant species was compiled into a database. The plant species were listed in alphabetical order by family, common/vernacular name, plant part used, voucher specimen number and medicinal uses. Descriptive statistics such as frequencies and percentages were used to analyse and summarise the data obtained. The importance of each plant species was assessed by the relative frequency of citation (RFC) calculated using the following formula (Tardio and Pardo-de-Santayana, 2008).

$$RFC = \frac{FC}{N}$$

where FC is the number of respondents who mentioned the use of the plant species and N is the total number of respondents interviewed.

RESULTS

Respondents’ sociodemographic data

A total of 56 respondents comprising 45 males (80.4%) and 11 females (19.6%) were interviewed in 26 villages in Ọdédá LGA, Ogun State, Southwest Nigeria (Table 1). Approximately 21.4% of the respondents were less than 40 years old, 48.2% were between 41-60 years and 30.4% were above 60 years old. Inheritance of the knowledge of traditional medicine from generation to generation was the major source of knowledge acquisition (98.2%). The general level of education of the respondents was low with 51.8% having some form of formal education while 48.2% were not educated at all (Table 1).

Sociodemographic data of livestock farmers in Qdédá local government area, Ogun State, Southwest Nigeria

es*	Village	Total number of respondents	Age	Sex	Educational status	Acquisition of traditio
	Abólómi, Abúlé Ìbàdàn, Abúlé Ọwẹ̀, Ajégúnlẹ̀, Ẹgbẹ́dá, Fàamí, Jákọ́lá, Lábùtà Olódodo, Ọ̀jọ́ọ́, Ọjọ́ọ́ Olúwo	23	Less than 15 (1) 15-25 (1) 26-40 (2) 41-60 (9) Above 60 (10)	Male- 20 Female- 3	Educated- 10 Not educated- 13	Inherited- 23 Learned- 0
	Ijù àgbẹ̀, Gbáròko, Máwùko, Tígbà	11	Less than 15 (0) 15-25 (0) 26-40 (3) 41-60 (6) Above 60 (2)	Male- 9 Female- 2	Educated- 7 Not educated- 4	Inherited- 11 Learned- 0
	Abulé Aké, Àgbétù, Ìdẹ̀ra, Ìkẹ̀rẹ̀kú Ìwẹ́rẹ́, Ìsólú, Odútólú	13	Less than 15 (0) 15-25 (1) 26-40 (3) 41-60 (6) Above 60 (3)	Male- 9 Female- 4	Educated- 8 Not educated- 5	Inherited- 12 Learned- 1
	Arógun church, Ewéjẹ́, Qdẹ́dá town, Ogbójà, Paápá-lúfàwòn	9	Less than 15 (0) 15-25 (0) 26-40 (1) 41-60 (6) Above 60 (2)	Male- 7 Female- 2	Educated- 4 Not educated- 5	Inherited- 9 Learned- 0

n to FUNAAB

Species of animals kept and diseases frequently encountered

The species of animals kept are mainly poultry (domestic chickens, turkey and ducks), small ruminants (sheep and goats) and cattle (by the Fulani settlers). Local dogs are also kept as companion, or for security and hunting purposes (Table 2). Diseases frequently encountered are Newcastle disease and coccidiosis in poultry; foot rot, helminthosis and bloat in small ruminants and foot rot, ticks and tick-borne diseases in cattle (Table 2).

Table 2: Types of animals kept and diseases frequently encountered by livestock farmers in Ọdédá local government area, Ogun State, Southwest Nigeria

Animals kept (vernacular name)	**Description of clinical signs seen**	**Suspected disease (vernacular name)**
Indigenous chickens (Adiẹ) Turkey (Tòlótòló) Ducks (Pẹpẹiyẹ)	Weakness, reluctance to move or come down from the shed, turning of head and neck	Newcastle disease (Kọ́ọ́lí)
	Discharge of watery faeces with blood, weakness	Coccidiosis (Bage-bage)
	White-like insects seen on the feathers	Lice infestation (Iná) Mite infestation (Yọ̀rọ̀)
Sheep (Àgùntàn) Goats (Ewúrẹ́)	The animal limps when walking and there is reluctance to move	Foot rot (Jẹsẹ̀-jẹsẹ̀)
	No gain in body weight despite good intake of feed	Helminthosis (Aràn)
	The stomach is swollen and the animal is not able to eat	Bloat (Ekún inú)
Cattle (Màlúù)	The animal limps when walking and there is reluctance to move	Foot rot (Jẹsẹ̀-jẹsẹ̀)
	Loss of appetite, loss of body weight, ocular discharge	Trypanosomosis (Arúgbẹ́)
	Presence of ticks on the body	Tick infestation (Eégbon)
Dogs (Ajá)	Presence of ticks on the body Animal behaves abnormally	Tick infestation (Eégbon) Rabies (Dìgbòlúgi)

Medicinal plant usage for specific ailments

A total of 24 plant species belonging to 15 plant families were used in the management of approximately 25 ailments described (Table 3 and 5). The families with the highest representation were Cucurbitaceae and Arecaceae families (16% each), followed by the Fabaceae (9%) and Solanaceae (7%) families (Table 3).

le 3: Different plant families and plant species used for management of specific ailments by smallholder farmers in O
l government area, Ogun State, Southwest Nigeria

Agalactia					
Family	**Fabaceae**	**Urticaceae**			
Species	*Pterocarpus osun* Craib.	*Urera obovata* Benth.			
Anorexia					
Family	**Caricaceae**	**Cucurbitaceae**			
Species	*Carica papaya* L.	*Lagenaria breviflora* Benth.			
Bloat					
Family	**Arecaceae**	**Rutaceae**			
Species	*Elaeis guineensis* Jacq.	*Citrus aurantifiolia* Swingle			
Brucellosis					
Family	**Bignoniaceae**				
Species	*Kigelia africana* (Lam.) Benth.				
Coccidiosis					
Family	**Cucurbitaceae**				
Species	*Lagenaria breviflora* Benth.				
Diarrhea					
Family	**Anacardiaceae**	**Arecaceae**	**Solanaceae**		
Species	*Spondias mombin* L.	*Elaeis guineensis* Jacq.	*Nicotiana tabacum* L.		
Dystocia					
Family	**Anacardiaceae**	**Euphorbiaceae**			
Species	*Spondias mombin* L.	*Ricinus communis* L.			
Ectoparasitism (mange, ticks and lice infestation)					
Family	**Arecaceae**	**Asteraceae**	**Cucurbitaceae**	**Moraceae**	**Rutace**
Species	*Elaeis guineensis* Jacq.	*Tridax procumbens* L.	*Lagenaria breviflora* Benth.	*Ficus exasperata* Vahl	*Citrus auranti* Swingle
			Momordica charantia L.		
Foot and mouth disease					
Family	**Fabaceae**	**Malvaceae**			
Species	*Vigna unguiculata* (L.) Walp.	*Abelmoschus esculentus* (L.) Moench			

Foot rot			
Family	**Rutaceae**		
Species	*Citrus aurantifiolia* Swingle		
Heart disease			
Family	**Bignoniaceae**		
Species	*Kigelia africana* (Lam.) Benth.		
Helminthosis			
Family	**Arecaceae**	**Cucurbitaceae**	**Euphorbiaceae**
Species	*Elaeis guineensis* Jacq.	*Momordica charantia* L.	*Manihot esculenta* Crantz.
Mastitis			
Family	**Bignoniaceae**		
Species	*Kigelia africana* (Lam.) Benth.		
Newcastle disease			
Family	**Cucurbitaceae**	**Fabaceae**	**Solanaceae**
Species	*Lagenaria breviflora* Benth.	*Tetrapleura tetraptera* Taub.	*Capsicum frutescens* L.
			Nicotiana tabacum L.
Pneumonia			
Family	**Cucurbitaceae**		
Species	*Lagenaria breviflora* Benth.		
Poisoning			
Family	**Arecaceae**		
Species	*Elaeis guineensis* Jacq.		
Rabies			
Family	**Amaryllidaceae**	**Dioscoreaceae**	
Species	*Allium cepa* L	*Dioscorea polystachya* Turcz. (syn. *Dioscorea batatas* Decne.)	
Skin infection			
Family	**Arecaceae**	**Asteraceae**	
Species	*Elaeis guineensis* Jacq.	*Lactuca taraxaciflora* (Willd.) Amin ex. C. Jeffrey	
Snake bite			
Family	**Caricaceae**		
Species	*Carica papaya* L.		
Trypanosomosis			
Family	**Cucurbitaceae**	**Solanaceae**	
Species	*Lagenaria breviflora* Benth.	*Nicotiana tabacum* L.	

Weakness			
Family	**Arecaceae**	**Caricaceae**	
Species	*Elaeis guineensis* Jacq.	*Carica papaya* L.	
Wounds			
Family	**Asteraceae**	**Euphorbiaceae**	**Fabaceae**
Species	*Chromolaena odorata* L.	*Jatropha curcas* L. *Manihot esculenta* Crantz.	*Mucuna pruriens* L.

Plant species and relative frequency of citation

Elaeis guineensis and *Lagenaria breviflora* were the plant species with the highest RFC (0.51 and 0.38 respectively) values in the 26 villages, followed by *Spondias mombin* (0.19), *Nicotiana tabacum* and *Carica papaya* (0.08), *Capsicum frutescens*, *Jatropha curcas* and *Manihot esculenta* (0.07). Most of the other plant species had RFC of 0.02 (Table 4).

Table 4: Different plant species and their relative frequency of citation in the management of specific ailments by smallholder farmers in Ọdédá local government area, Ogun State, Southwest Nigeria

Plant species	Relative frequency of citation
Allium cepa	0.04
Capsicum frutescens	0.07
Carica papaya	0.08
Chromolaena odorata	0.04
Citrus aurantifolia	0.06
Dioscorea polystachya	0.05
Elaeis guineensis	0.51
Ficus exasperate	0.05
Jatropha curcas	0.07
Kigelia Africana	0.04
Lactuca taraxacifolia	0.02
Lagenaria breviflora	0.38
Manihot esculenta	0.07
Mormodica charantia	0.04
Mucuna pruriens	0.02
Nicotiana tabacum	0.08
Pterocarpus osun	0.02
Ricinus communis	0.02
Spondias mombin	0.19
Tetrapleura tetraptera	0.04
Tridax procumbens	0.02
Urera obovate	0.02
Zea mays	0.04

Medicinal plant diversity and usage

A total of 24 plant species belonging to 15 plant families were listed (Table 5). The family with the highest representation was the Fabaceae family with four plant species (16.7%), followed by Asteraceae and Euphorbiaceae families with three plant species each (12.5%). The Solanaceae and Cucurbitaceae families were represented by two plant species each (8.3%). The remaining ten plant families were each represented by one plant species each (4.2%) (Table 5).

The plant parts used were the leaves (35%), fruit (35%), seeds (11%), tubers (10%), roots (5%) and stem bark (4%) (Fig. 4). Herbal medicines were prepared mainly by soaking the plant species in cold water to make infusions (48.2%), boiling in water to make decoctions (3.6%) or burning leaves to emit smoke (8.9%) (Table 5). Some of the respondents also used a combination of different plant species and plant parts (concoctions) (Table 5). Oral and topical routes were the main routes of drug administration employed (Table 5). There was no report of any adverse effects from the use of these plant species.

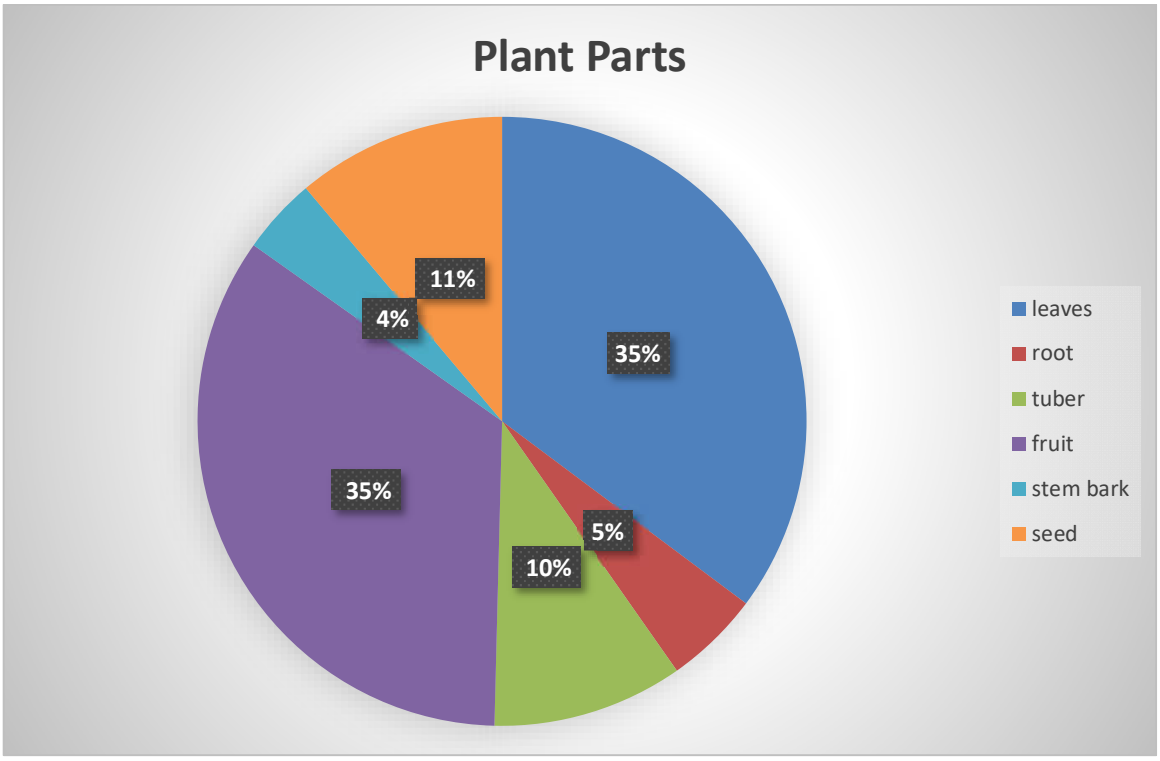

Figure 4: Plant parts used in the management of specific ailments by smallholder farmers in Qdédá local government area, Ogun State, Southwest Nigeria

Literature survey

Of the listed plant species, approximately 83% were found to have similar ethnomedicinal claims in some other regions of the world. In addition, 86% of the plant species have been reported to be pharmacologically active in the literature (Table 6).

e 5: Medicinal plant species used for the management of specific ailments by smallholder farmers in Ọdédá local govern Ogun State, Southwest Nigeria

	Species	Voucher specimen Number	Common names	Vernacular names	Part used	Mode of preparation	Route of administration
e	*Allium cepa* L.	MPNH/2019/01292	Onion	Àlùbọ́sà	Fruit Seed	Onion is mashed and mixed with palm kernel oil, poured into a hole made inside Chinese yam (*Dioscorea polystachya)*. The animal licks from the hole and some of it is rubbed on the body of the affected animal	Oral Topical
	Spondias mombin L.	MPNH/2019/01286	Yellow mombin Hog plum	Ewé ìyeyè	Leaf	The leaves are given to the animal (sometimes after gentle heat treatment) to eat or used to massage the rump of the animal	Oral Topical
	Chromolaena odorata (L.) R.M. King & H.E. Robins (syn. *Eupatorium odoratum* L.)	MPNH/2018/01262	Siam weed Christmas bush	Ewé àgàtú Ewé Akíntọ́lá	Leaf	The leaves are mashed and applied on wound to stop bleeding and hasten healing	Topical
	Lactuca taraxaciflora (Willd.) Amin ex. C. Jeffrey (syn. *Launaea taraxaciflora*)	MPNH/2019/01275	Wild lettuce	Ẹ̀fọ́ yanrìn	Leaf	The leaves are squeezed and the juice extracted is rubbed on the skin lesion	Topical
	Tridax procumbens L.	MPNH/2018/01270	Tridax daisy	Sàbárùbá	Leaf	The leaves are squeezed in water and used to wash the body	Topical
	Elaeis guineensis Jacq.	MPNH/2019/01274	African oil palm (palm kernel oil)	Ọ̀pẹ	Seed	The palm kernel oil extracted from the seeds is given orally	Oral
					Fruit	Palm kernel oil is rubbed on the body of the animal	Topical
					Fruit	Palm kernel oil is rubbed on the body of the animal	Topical
	Kigelia africana (Lam.) Benth.	MPNH/2019/01290	Sausage tree	Pańdọ̀rọ̀	Fruit	The fruit is sliced, soaked in a bowl of water, then given to the animal to drink	Oral
					Stembark	The bark of the tree is cut and ground with potash, mixed together and allowed to dry. Salt is added and served to the animal as a lick	Oral

Carica papaya L.	MPNH/2018/01259	Pawpaw	Ìbẹ́pẹ	Fruit	The fruit is sliced inside a bowl of water for the animal to drink	Oral
					Ripe pawpaw is used to rub the skin of the animal	Topical
				Stem	The stump of pawpaw is sliced and latex from the stem placed on the bite site	Topical
Lagenaria breviflora (Benth.) Roberty	MPNH/2019/01282	English wild colocynth	Tágìrì	Fruit	The fruit is sliced inside a bowl of water for the animal to drink [sometimes chilli pepper (*Capsicum frutescens*) is added]	Oral
Momordica charantia L.	MPNH/2019/01276	Bitter melon	Ejìrìn	Leaf	The leaves are boiled and the decoction given to affected animals (calves) as drench in the morning	Oral
					The leaves are crushed with black soap to bath dogs weekly	Topical
Dioscorea polystachya Turcz. (syn. *Dioscorea batatas* Decne.)	MPNH/2019/01283	Chinese yam	Èsù ẹgàn	Tuber	A hole is made in the tuber of yam and mashed onion mixed with palm oil is poured into the hole. The animal licks from it and it is also rubbed on the body	Oral Topical
					The yam is pounded, mashed with palm kernel oil and given to the animal to lick	Oral
Jatropha curcas L.	MPNH/2018/01264	Physic nut	Bútújẹ́ Ewé làpálàpá	Leaf	The leaves are plucked and the dripping latex is applied directly on wound	Topical
Manihot esculenta Crantz.	MPNH/2018/01261	Cassava	Ègẹ́ Pákí,	Tuber	The tuber is sliced and soaked in a bowl of water. The infusion is used to stop bleeding	Topical
Ricinus communis L.	MPNH/2019/01287	Castor oil plant	Ewé laa/lara	Leaf	The leaves are squeezed in water and given to cows as drench after parturition	Oral
Vigna unguiculata (L.) Walp.	MPNH/2019/01291	Cowpea	Iyeye	Fruit Seed	Cowpea pods, okra (*Abelmoschus esculentus)* stump and honey are mashed together and placed in lighted charcoal pots which are placed at the four corners of the paddock. The fumes produced is inhaled by the animals	Inhalation
Mucuna pruriens (L.) DC.	MPNH/2019/01280	Velvet bean	Wèrèpè	Leaf	The leaf is mashed with wood ash and applied on a bleeding wound	Topical
Pterocarpus osun Craib.	MPNH/2019/01295	Camwood	Osùn	Fruit	Camwood is sliced inside a bowl of palm kernel oil and rubbed on the udder only	Topical
Tetrapleura	MPNH/2019/01284	-	Àrídán	Root	The root is sliced inside a bowl of water to	

tetraptera Taub.					soak in which the birds drink from.	
Abelmoschus esculentus (L.) Moench	MPNH/2019/01296	Okra Ladies' fingers	Ilá	Fruit Seed	The stump is mashed with cowpea pods and honey and placed on lighted charcoal pots which are placed at the four corners of the paddock. The fumes produced is inhaled by the animals	
Ficus exasperata Vahl	MPNH/2018/01263	Sandpaper tree	Ewé ẹpin	Leaf	The leaves are scattered in the pen house of birds	Environment
Citrus aurantifolia (Christm.) Swingle	MPNH/2018/01257	Key lime	Ọsàn wẹ́wẹ́	Fruit	The fruit is sliced and used to rub the animal's body	Topical
					The fruit is sliced inside a bowl containing urine of cattle. The mixture is rubbed on the lesion every morning	Topical
Nicotiana tabacum L.	MPNH/2018/01272	Tobacco	Ewé tábà	Leaf	The leaf is mixed with *Lagenaria breviflora* in water for birds to drink	Oral
					The leaves are squeezed to get the juice, drawn into a syringe and given orally	Oral
					The leaf is ground and applied to the medial canthus of the eye of the cattle	Intra-ocular
					The leaf is ground and mix with lime juice then administered orally	Oral
Capsicum frutescens L.	MPNH/2019/01285	Chilli pepper	Ata ìjọsìn	Fruit	Chilli pepper and chinese yam are sliced, soaked in water and given to birds to drink	Oral
Urera obovata Benth.	MPNH/2019/01288	Scratchbush	Ewé esìsí	Leaf	It is squeezed and used to rub the udder	Topical

e 6: Reported similar ethnobotanical management, pharmacologic studies and isolated compounds from medicinal plant sp
for the management of specific ailments by smallholder farmers in Ọdẹdá local government area, Ogun State, Southwest Nig

	Species	Disease	Similar ethnobotanical claims	Similar pharmacologic activities	Some isolated compounds	References
e	*Allium cepa* L.	Rabies	NR Plethora of uses	Immunoprotective and anti-oxidant activities	Flavonoids, organosulfur compounds, polyphenols, quercetin, S-alk(en)yl-L-cysteines, γ-Glutamyl peptide	**Sohail et a** **Teshika et**
	Spondias mombin L.	Dystocia	Eastern Nigeria - Fresh leaves are widely used to aid delivery and expel the placenta in small ruminants (sheep and goats), especially during difficult labor Peru - Decoctions of the bark and/or leaves are *used* as a 'child birth aid'. Also *used* in postpartum infections of the uterus and following an abortion or miscarriage	Hydro-ethanolic leaf extract of *S. mombin r*educed labour time, induced vaginal opening, increased uterus and ovarian weight and reduced coagulation time Abortifacient activity	Carotenoids, phytoene, α-trans-β-carotene, α-carotene, β-crytoxanthin (cis and trans), zeinoxanthin, lutein	Ayoka et al. Uchendu an Offiah and [b] Pakoussi et Hamano a (2001) [c]
	Chromolaena odorata (L.) R.M. King & H.E. Robins	Wound	Vietnam; India - Varied plant parts have been used to treat *wounds*, burns and *skin infections*	Aqueous extract inhibits hydrated collagen lattice contraction by normal human dermal fibroblasts	Acacetin, chalcones, eupatilin, luteolin, naringenin, kaempferol, quercetin, quercetagetin, sinensetin	Phan (1996) Sirinthipapo Jiraungkoor
	Lactuca taraxaciflora (Willd.) Amin ex. C. Jeffrey	Fungal infection	Ghana; Southwest Nigeria - Leaves used to prevent and/or cure skin diseases	Aqueous and methanol extracts caused high fungistatic effects	Palmitic acid, methyl-11-octadecenoate, erythritol, glycerol, linolelaidic acid, methyl ester, phytol	Ololade et a Sakpere and [b]
	Tridax procumbens L.	Ringworm	India - The juice extracted from the leaves is directly applied on wounds. Also used for infectious skin diseases in folk medicines	Methanolic extract showed great potency against *Candida albicans* and *Aspergillus flavus*	Alkaloids, polyphenol, tannins, flavonoids, carbohydrates, saponins, glycosides	Taddei and (2000) [b] Sarkar et al. Singh et al.
	Elaeis guineensis Jacq.	Skin infection	Malaysia - The juice from the leaves is used to promote wound healing and for skin infections	Antibacterial, anti-oxidant, wound healing activities	Alkaloids, terpenoids, phenolic compounds, steroids, flavonoids, carotenoids, catechins	Sasidharan Dal Pra et a

Kigelia africana (Lam.) Benth.	Mastitis	Benin Republic- The bark is prepared as decoction to treat mastitis	Antimicrobial and anti-oxidant activities	Alkaloids, saponins, flavonoids, carbohydrates, sapogenetic glycosides	Agyare et a Noudeke et
Carica papaya L.	Anorexia	Guyana – All parts of the plant are used for the treatment of gastrointestinal tract diseases India- Treatment of eczema, dandruff and appetite stimulant	Anti-inflammatory and ulcerogenic activities. Methanolic extract showed antimicrobial activity	Tannins, steroids, saponins, glycosides	Farooq (201 Aravind et a Tewari et al
Lagenaria breviflora (Benth.) Roberty	Newcastle disease	West Africa – Prevention and treatment of Newcastle disease and coccidiosis	Antiviral, anti-inflammatory, analgesic activities	Octadecane, heptadecane, hexacosane, 1,2-benzenedicarboxylic acid, mono(2-ethylhexyl) ester	Oridupa and Adedapo et Adeyemi et
Momordica charantia L.	Tick infestation	Panama; Haiti – Insecticide	Acaricidal activity	Nonacosane	Gandhi et a
	Helminthosis	Mexico; India; Cuba; Togo – Intestinal parasites	Anthelminthic activity	Momordicin I, momordicin II	Beloin et al Kumar and [a]
Dioscorea polystachya Turcz	Bloat	China – Used as a stomach tonic, in improving appetite, treating diarrhea and as a diet food	Ethanolic extract induced improvement in digestive capability	Diosgenin, dioscorin, dioscin	Jeon et al. (Babil et al.
Jatropha curcas L.	Wound	Saint Lucia; Peru - Leaves are pounded, olive oil or lard added and used as a poultice to heal sores	Wound healing activity	Jatrophine, jatropham, curcain, apigenin, vitexin, isovitexin	Villegas et a Esimone et Thomas et a
Manihot esculenta Crantz.	Wound	Sri-Lanka - Used for wound healing	Anti-oxidant activity	Coniferaldhyde, isovanillin, 6-deoxyjacereubin, scopletin, syringaldehyde, pinoresinol, p-coumaric acid, ficusol, balanophonin, ethamivan.	Yi et al. (20 Chandrasek (2016) [a]
Ricinus communis L.	Dystocia	Ethiopia - The roots are used to relieve retained placenta in animals	Anti-microbial, anti-inflammatory and anti-implantation activities	Epicatechin, quercetin, ingenol catechin, ricin, athujone	Abdul et al. Assefa and

Vigna unguiculata (L.) Walp.	Foot and mouth disease	NR	Antioxidant/free radical scavenging and antibacterial activities	Saponincycloartenol, stigmasterol, oleanolic acid acetate, sitosterol β-D-glycosides	Ibrahim et a
Mucuna pruriens L.	Wound healing	India and West Africa – Dog bite, snake bite, sores	Anabolic, analgesic, anti-inflammatory, immune modulating and antibacterial activities	Alkaloids, glycosides, reducing sugars, saponins, tannins, terpenoids, polyphenolic substances, phytic acid, L-dopa	Divya et al.
Pterocarpus osun Craib.	Agalactia	NR India – Treatment of inflammation	Anti-oxidant activity	Phenol, saponins, tannins, cardiac glycosides, sterols, terpenes	Shobayo et
Abelmoschus esculentus (L.) Moench	Foot and mouth disease	Nepal - The juice of the roots is used to treat cuts, wounds and boils	Anti-oxidant, anti-inflammatory, immunomodulatory and antibacterial activities	Pectin, epigallocatechin, quercetin	Chanchal et Islam (2019 Durazzo et a
Tetrapleura tetraptera Taub.	Newcastle disease	Nigeria – Infusion of the whole fruit is taken as a recuperative tonic Ghana – Immune booster	Anti-inflammatory activity	27, hydroxyolean 12(13)-en-28-oic acid, umbelliferone, ferulic acid, aridanin	Aladesanmi Kemigisha
Ficus exasperata Vahl	Ectoparasitism	Ile-Ife, Nigeria – To control mites and lice in poultry	NR Antimicrobial activity	Flavonoids, saponins, tannins, steroids, phlobatannins	Sonaiya (20
Citrus aurantifolia (Christm) Swingle	Tick infestation	Malaysia; Nigeria – The rind is burnt to repel insects and other ectoparasites	Acaricidal, anticholinesterase, anti-oxidant and antimicrobial activities	β-caryophyllene, citronellol, germacrene B, kaempferol, limonene, quercetin, rutin, sabinene	Chungsama Jansawan (1 Enejoh et al
Capsicum frutescens L.	Newcastle disease	Tanzania; Saint Lucia; Bangladesh – Used with other leafy vegetables for the treatment of several diseases including Newcastle disease	Anti-oxidant and antimicrobial activities	Capsaicin, dihydrocapsaicin, chrysoeriol	Rahmatulla Nascimento
Nicotiana tabacum L	Newcastle disease	Botswana- Treatment of poultry diseases including Newcastle disease, coccidiosis	Antiviral activity	Tabaisocoumarin A-C, phenolic compounds	Moreki et a Chen et al. (Shang et al.
Urera obovata Benth.	Milk-let-down	NR Côte d'Ivoire - The leaves are eaten as an aphrodisiac Nigeria – A leaf decoction is used as a laxative for pregnant women/animals	NR	Linoleic acid, linolenic acid	Arthur (195

NR-Not reported; [a]Reference for similar ethnobotanical claims; [b]Reference for similar reported pharmacological activities; [c]Reference for isolated compounds

Other ethnoveterinary practices and folklore beliefs

In six of the villages visited, some other ethnoveterinary practices and folklore beliefs were reported (Table 7).

Table 7: Other ethnoveterinary practices and folklore beliefs associated with the management of specific ailments by smallholder farmers in Ọdédá local government area, Ogun State, Southwest Nigeria

Village	Traditional practices	Folklore beliefs
Abulé Aké		Any animal/human bitten by a snake should be made to look at the sky immediately, so the patient does not die from the venom If a goat is laid on its side and a folded cloth (òsùká) is used as cus hion between its head and the ground, the animal will not struggle or stand up. That way, physical examination of the animal can be c arried out
Arógun church	Medicinal leaves are not plucked after 8:00 p.m	Poultry rearing is forbidden as it brings bad luck
Fàamí	*Ficus thoningii* (odan) leaf is used as glue for joining torn money/paper or any adhesives on animals	
Ẹgbẹ́dá		"Adìe ki ń te sẹ̀ kú" which means no feet related disease can kill ch ickens
Ìkẹ̀rẹ̀kú Ìwẹ́rẹ́	Dog bite is healed by applying corn pap to clean the wound and the same pap is given to the dog to drink to relieve the bite Use of sand mixed with water to control diarrhea	
Ọjọ́ọ́ Olúwo	Use of smoke in the cattle's paddock to drive away ticks Use of hot iron to carefully drive away ticks and lice from the body of cattle	

DISCUSSION

The search for safe, potent and less resistant templates for newer drugs to combat emerging and re-emerging diseases has led researchers to seek to identify and investigate medicinal plants (Atanasov et al., 2015). This search for new molecules has taken a slightly different route where the science of ethnobotany and ethnopharmacognosy are being used as a guide to lead chemists towards different sources and classes of compounds with possible novel mechanisms of action. In line with this, the flora of the tropics by its diversity has a significant role to play in being able to provide new leads (Gurib-Fakim, 2006). This study shows that male respondents were greater in number than female respondents and the age group of 41-60 years showed more interest in the traditional beliefs of using medicinal plants as remedies for livestock diseases. This agrees with Salihu et al. (2018), who reported that information on medicinal plants is mostly stored in the memory of a few older people entrusted with it within communities.

The lack of and/or inadequate formal education in traditional knowledge in developing countries has been reported to be a contributing factor in the decline of herbal medicine (Teshome et al., 2005). In this study, 48.2% of the respondents had no formal education while 51.8% of the respondents had some basic form of education (majorly primary school only). A total of 24 plant species distributed in 15 families were reported by the respondents. Most of the listed plant species grew naturally in the surroundings which show the vast abundance of the plant species in our locality and a possibility of tapping into these resources. The highest represented families were Fabaceae (four species), Euphorbiaceae (three species) and Asteraceae (three species). The plant species were used singly or in combination for the treatment of different livestock diseases. The most cited plant species were *Elaeis guineensis* (52.27%) and *Lagenaria breviflora* (47.73%). *Elaeis guineensis* is used for the treatment of different ailments of livestock in Ọdédá LGA which include skin infections, poisoning, helminthosis, mange, diarrhea and bloat. Its use may be attributed to the presence of compounds isolated from it, which include flavonoids documented to have important effects on various biological systems (Yin et al*.,* 2013).

The use of *Lagenaria breviflora,* which was majorly mentioned for the treatment of Newcastle disease and coccidiosis in poultry, agrees with the study of Adedapo et al. (2013) and Olorunnisola, et al. (2015), where the plant was efficacious against inflamed purulent wounds, swellings and bruises seen in infectious diseases such as Newcastle disease. Its pharmacological activities can be attributed to its isolated compounds such as octadecane, heptadecane, hexacosane, 1,2-benzenedicarboxylic acid and mono(2-ethylhexyl) ester (Adeyemi et al., 2017). The leaves and fruits were the plant parts mostly used for the preparation of medicine. The preference for leaves, which had the highest percentage of use, corresponds with other reported studies (Agbodeka et al*.,* 2016; Salihu et al*.,* 2018). The respondents may be conservation conscious so that they can sustain their supply of this herbal resource. The mode of administration of the remedies mostly used was the oral route for systemic diseases and topical treatment for mainly ectoparasitism. Others included intra-ocular administration as in the case of the use of *Nicotiana tabacum* for the treatment of trypanosomosis.

Bacteria and fungi are the main causes of different infectious diseases in animals and humans. In different studies, some of the listed plant species such as *Allium cepa* (onion) and *Capsicum frutescens* (chilli pepper) have been reported to show protective effects against **pathogenic bacteria** (e.g. ***Escherichia coli,*** *Pseudomonas* species) and fungi (e.g. *Candida, Cryptococcus* species) (Benkeblia et al., 2004; Shams-Ghahfarokhi et al., 2006).

Many of the plant species (83%) reported in this study had similar ethnoveterinary uses in several other parts of the world. *Lageneria breviflora* is used for the prevention and treatment of Newcastle disease in several West African countries (Adedapo et al., 2013). *Citrus aurantifolia* is used as an insecticide in Malaysia (Enejoh et al., 2015). Many of the plant species were also used for several ailments in humans and employed if similar symptoms are observed in animals e.g *Spondias mombin* is used to relieve dystocia in humans and animals (Ayoka et al.,

2008). This agrees with Caudell et al. (2017) who reported the nature and coexistence of EVM and ethnomedicine amongst the East African agropastoralists. The correlation of the traditional uses of some of the listed plant species with their known phytochemical and pharmacological properties lends credence to some of the ethnomedicinal claims.

Folklore beliefs include that the plucking of leaves after 8:00 p.m is prohibited as it is believed that the plant species (being living things) need to sleep at night. The use of corn pap to dress dog bite wounds on a human body and giving the pap to the dog to eat to relieve pain in the human are myths believed by the people of Ìkẹ̀rẹ̀kú Ìwẹ́rẹ́ village. Researchers need to explore the role of folklore in expressing fundamental human needs, desires, and anxieties that often are not revealed through other means (Fernandez-Duque and Schwartz, 2016). Appropriate methodologies for identifying, documenting, interpreting and applying key information about folklore and its relevance to modern life and EVM cannot be overstated.

CONCLUSION

This study reports the use of 24 plant species in the management of some diseases of livestock in Ọdédá LGA, Ogun State, Southwest Nigeria. It also considers the threat of loss of traditional knowledge, which is largely orally transmitted between generations. The examination of folk knowledge and EVM practices will give us a better understanding of human interactions with their local environment and aid in formulating appropriate strategies for the validation of traditional remedies and for natural resource conservation.

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