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ETHNOBOTANICAL SURVEY OF MEDICINAL PLANTS USED IN TREATING SNAKEBITES IN BENUE, NIGERIA

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ABSTRACT
Snakebites are a major health concern in rural Nigeria which have led to high mortality and suffering in victims due to lack of basic social amenities, ill-equipped hospitals, costly treatments and distance to hospitals. An alternative to treat snakebites is the utilization of herbal invigorating plants however traditional knowledge about plants used for snakebites is not well documented and is rapidly disappearing. Here, we present an ethnobotanical survey of the medicinal plants used for treating snakes bites by the people of southern Benue, mainly the Idoma people. Our survey recorded 18 plant species, belonging to 11 families, used to treat snakebites. The family Fabaceae is represented by 5 species, Annonaceae, Connaraceae and Malvaceae had two useful species each, while the remaining families had only one species each. The leaves were the most utilized plant parts (55.6%), followed by bark (5.5%), seeds (5.5%), roots (27.8%) and whole plant (5.5%). The reported species are mostly administered topically onto the bitten area, sometimes the leaves or barks are chewed, and plant extracts/decoctions are drunk to neutralize snake venom. The need to subject the identified plant species to phytochemical validation and physiochemical tests is imperative to contribute to cost-effective snake antivenom in Nigeria.
KEY WORDS: *antivenom, ethnobotany, Idoma, indigenous knowledge, West Africa*

INTRODUCTION

Despite significant advances in our understanding of several occupational and environmental hazards, snakebites with envenomation remain a neglected public health concern worldwide leading to high mortality and great suffering (Gutierrez *et al.*, 2007; Harun *et al.*, 2013; Ameen *et al.*, 2015; Upasani *et al.*, 2017; Ebrahimi *et al.*, 2018). The highest incidence of snakebites is recorded in sub-Saharan Africa, Asia and South East Asia. In Nigeria, the Benue valley has the highest rates (Habib & Warrell 2013), likely due to the livelihood strategies of the population (farming, hunting, fishing and animal husbandry) and favorable environmental conditions (high rainfall and year-round warm climate) for snakes (Alirol *et al.*, 2010; Pugh & Theakston 1980; Ribeiro *et al.*, 1995; Borges *et al.*, 1999; McNamee 2001; Sani *et al.*, 2013).

Globally, the most common and effective method of treating snakebite victims is through antivenom; a serum made from the venom of the snake (Gomes *et al.*, 2010). However, most snakebite and envenomation victims are rural dwellers that

cannot afford expensive antivenoms, lack access to well-equipped hospitals, or have to travel considerable distances to receive treatment. Additionally, there is a challenge of allergies when using anti-venoms as some individuals may react with an immediate hypersensitivity reaction (Faur *et al*, 2001; Gomes *et al.*, 2010; Habib & Warrell 2013; Ameen *et al.*, 2015).

An alternative to treat snakebites is the utilization of herbal invigorating plants. Herbal plants are commonly used because they are inexpensive, readily available and viable (Hostettman *et al.*, 2000; WHO 2001, 2010; Gupta & Peshin 2012). However, information on these remedies is often passed on from one generation to another within a lineage by oral tradition and much of the traditional knowledge is kept secret from outsiders (Lewis and Elvin-Lewis 2003). Regrettably, there is a decline in this traditional practice due to lack of interest by the younger generations, religious practices and lack of documentation (Sofowora 1993; Asuzu &Harvey 2003; Cox 2005; Perumal *et al.*, 2008).

In Nigeria, most of the plants used to treat snakebites by rural dwellers or traditional practitioners are not well documented. Also, ethnobotanical studies in Nigeria thus far have not documented the Benue region despite being a snake endemic area (Ismaila & Adamu 2012; Nnamani & Ukwa 2015). Today, the state's biodiversity is under severe threat from habitat conversion, cattle grazing and unsustainable human activities. Moreover, the rate of transhumance in Benue is greater than in any other state in the country. Together, these activities are not only jeopardizing the continued existence of wild medicinal plants, but are putting many species on the verge of local extinction. Therefore, it is imperative to document, preserve and protect the ethnobotanical information on medicinal plants used in treating snakebites in this region.

MATERIALS AND METHODS

Study site

The study was conducted in the southern region of Benue State (7.3508°N, 8.8363°E) which has an area of about 34,059 km^2 (Fig. 1). The state of Benue shares boundary with Nassarawa to the north, Cross River to the south, Taraba to the east, Kogi to the west, Enugu to the southwest, and an international boundary with the Republic of Cameroon to the southeast around Kwande and Oju Local Government Areas. Benue land is generally flat with steep slopes, rugged mountain terrains located at the interface between Nigerian and Cameroon and occasional undulating terrain with inselbergs and outcrops in specific locations. Owing to its soils (sandy loams) and alluvial plains, annual rainfall that ranges from 100–200 mm and temperatures of 23–37^o C, the region has a great agricultural potential.

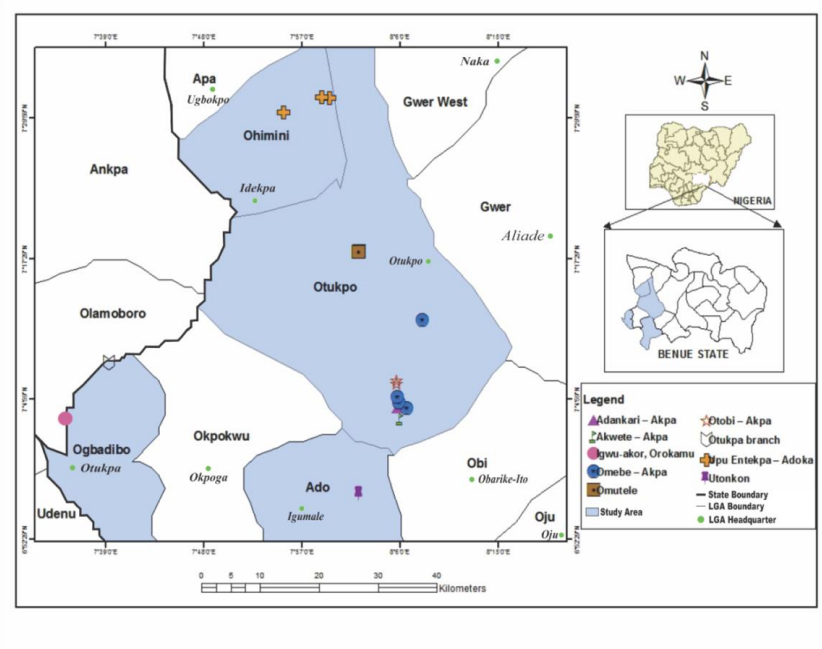


FIG. 1: Map of study area

The major ethnic groups of Benue are the Tiv, Idoma and Igede whom are predominantly farmers. Common tree species within the study area include: *Afzelia africana* Sm, *Daniellia oliveri* (Rolfe) Hutch. & Dalz, *Khaya senegalensis* (Desr.) A. Juss. *Vitex doniana* Sweet, *Vitellaria paradoxa* Gaertn.F, *Nauclea diderrichii* (De Wild. & Th. Dur.) Merrill, *Terminalia schimperiana* Hochst., *Prosopis africana* (Guill. & Pen.) Taub, *Parkia biglobosa* (Jacq.) Benth. and *Detarium microcarpum* Guill. & Perr. among others (Alyegba *et al.,* 2013). Guinea savannahs are found in the eastern and northern parts of Benue while rain forest vegetation is prominent in the western and southern fringes with potential for development of forest and wildlife reserves.

Data collection. Three field trips were made between January to December 2017 within the Local Government Areas (LGAs) of southern Benue to collect and identify plants used traditionally for the treatment of snakebites. A verbal consent to participate was sought from the inhabitants in the presence of the traditional council and they willingly participated in the study. Ethnobotanical data were collected through individual interviews using open-ended questionnaires. Information on the local names, plant part(s) used in treatment, condition of the plant materials (fresh or dried), methods of preparation and modes of administration of these plants were recorded in the field following Jovel *et al.,* (1996) and Harun *et al.,* (2013). Interviews were conducted with the help of an interpreter. A photograph of each plant species was

taken in the field and botanical samples were collected and prepared according to conventional herbarium techniques (Olorode 1984; Ribeiro *et al.*, 1995). Some of the medicinal plants were identified in the field and the remaining ones were identified using keys from relevant literatures such as Hutchinson & Dalziel (1954). Voucher specimens were deposited at the Lagos University Herbarium (LUH) of Department of Botany, University of Lagos, Nigeria.

RESULTS AND DISCUSSION

A total of seventy-nine (79) informants from the Idoma ethnic group were interviewed independently. Their demographic profiles are summarized in Table 1. Fifty informants (63%) were males while 29 (37%) where females. Also, over 50% of the respondents were less than 50 yrs of age (Fig. 2). The occupation of respondents included farmers (29%), students (27%), hunters (16%), traditional healers and elder villagers (15%) and traders (13%) (Fig. 3).

Only about 19% of the respondents have been victims of snakebites and 13% of these were unable to identify the snake (Table 2). Most snakebite incidents occurred between September and October (Fig. 4). A total of 18 plant species belonging to 11 families were recorded to be used by the tribal communities to treat snakebites. The provenance of sample, scientific name, family, local/vernacular name, part(s) used, description of mode of preparation/administration of the plants are presented in Table 3. Photographs of the plant samples are shown in plate 1.

TABLE 1: Summary of demographic profile of the informants

Variable	Frequency (n=79)	Response (%)	Variable	Frequency (n=79)	Response (%)
Sex			**Applicable treatment centre**		
Male	50	63.29	Hospital	16	20.25
Female	29	36.71	Traditional	63	79.75
Age range			**Religion**		
20 – 30	13	16.46	Islam	6	7.59
31 – 40	8	10.13	Christian	63	79.75
41 – 50	20	25.32	Traditional	10	12.66
51>	38	48.10	Atheist	0	0.00
Working experience			**Victim of snake bite**		
Yes	44	55.70	Yes	15	18.99
No	35	44.30	No	64	81.01
Month of incidence			**Educational qualification**		
Jan. – Feb	1	1.27	Primary	22	27.85
Mar. - Apr.	5	6.33	Secondary	45	56.96
May - Jun.	7	8.86	Diploma	3	3.80
Jul. – Aug	17	21.52	Degree/HND	9	11.39
Sept. - Oct.	23	29.11	Islamiya	0	0.00
Nov. - Dec.	12	15.19	None	0	0.00
Marital status			**Occupation**		
Single	42	53.16	Student	13	16.46

Married	30	37.97	Herbalist	21	26.58
Divorced	7	8.86	Hunters	12	15.19
			Traders	10	12.66
			Farmers	23	29.11

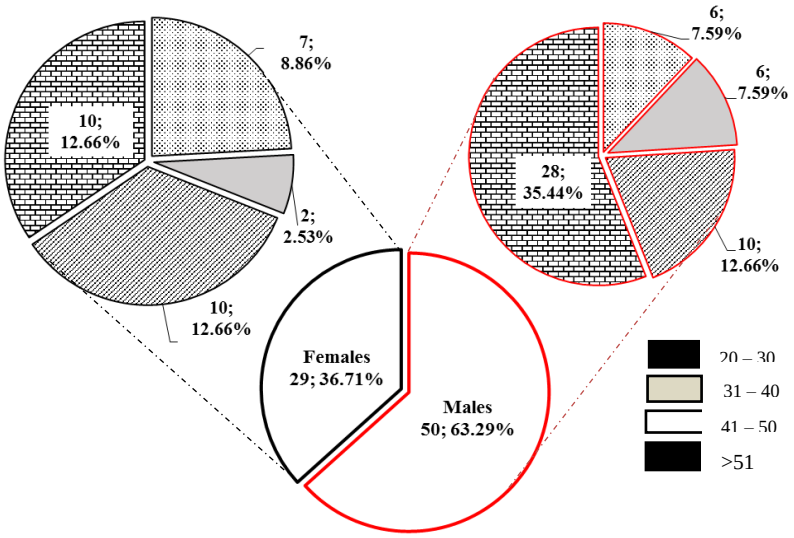


FIG. 2: Gender and age distribution of the respondents

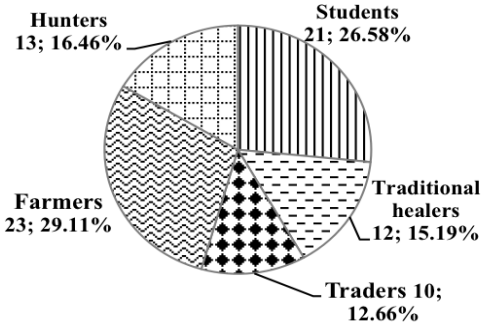


FIG. 3: Distribution of the respondents by occupation

TABLE 2: Distribution of snakebite encounters among 79 respondents

Characteristics	Victim of snake bite		Not victim of snake bite	
	Frequency (n)	Response (%)	Frequency (n)	Response (%)
Able to identify snake	5	6	5	6
Not able to identify snake	10	13	59	75
Total	15	19	64	81

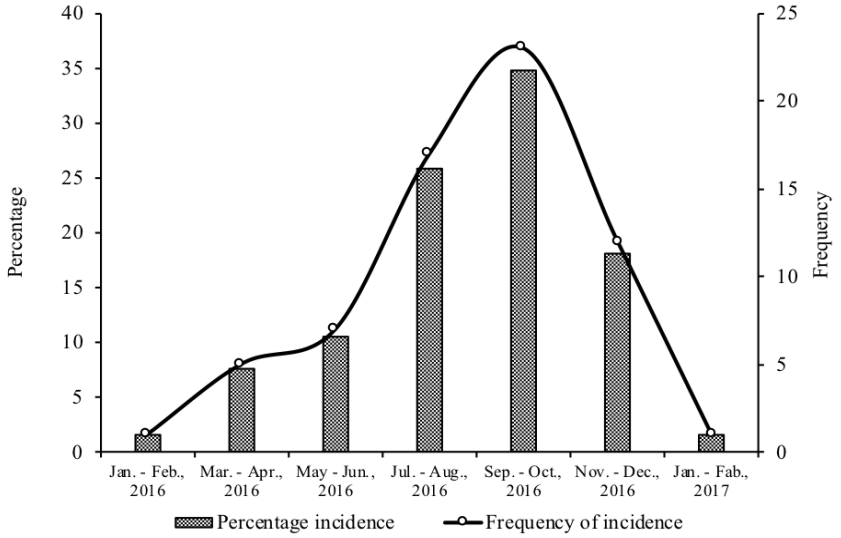
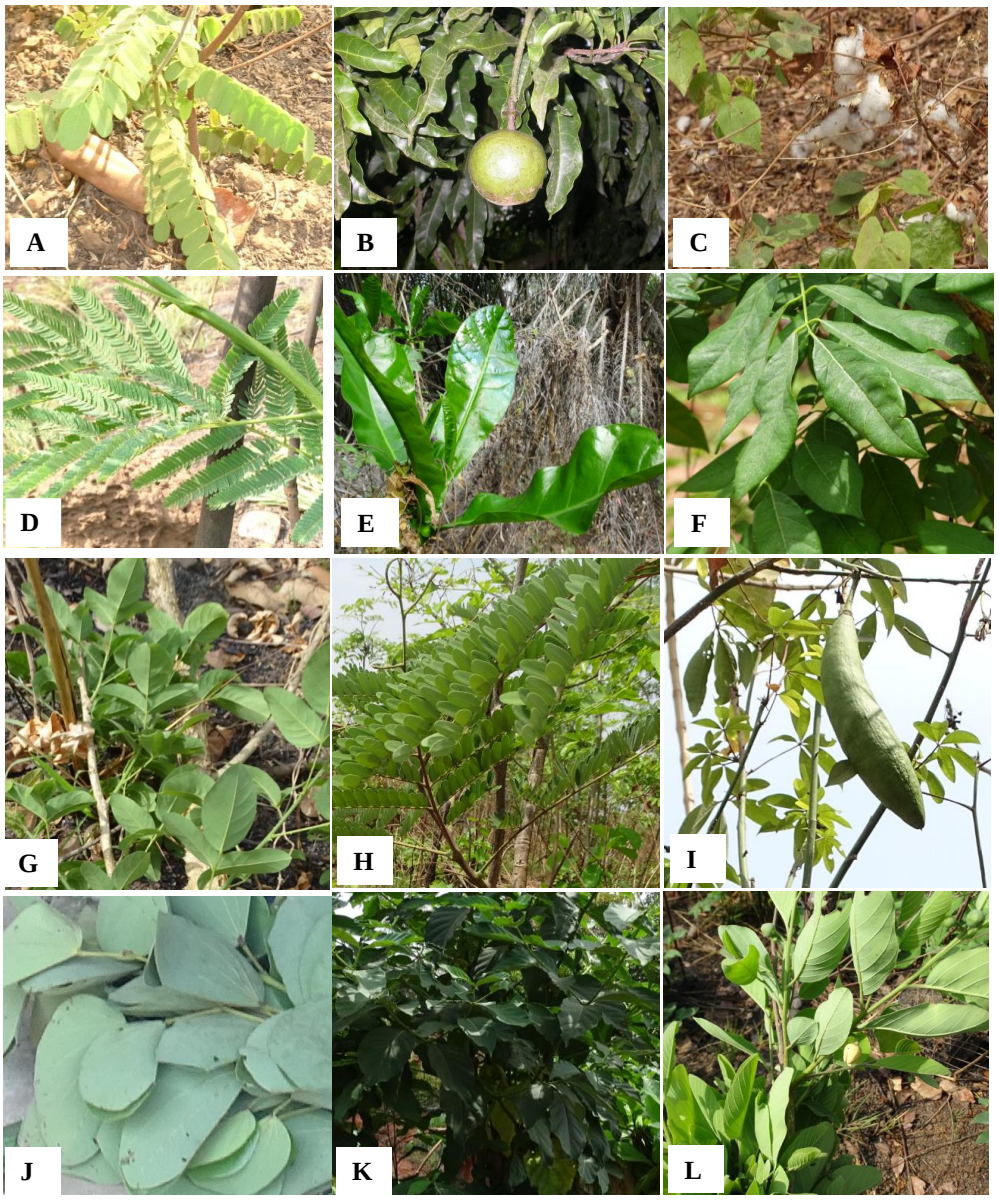


FIG. 4: Incidence rate of snake bite in Benue and the months of occurrence

TABLE 3: Plant species used for treating snakebites by the Idomas in Benue State, Nigeria

Scientific name	Family	Local name	Part used	Administration	Coordinates
Annona senegalensis Pers.	Annonaceae	*Kpokpo*	Bark	Oral	7^0 06.333'N, 8^0 05.687'E
Anthocleista vogelii Planch.	Loganiaceae	*Odrogwu*	Root	Oral/Topical	7^0 12.054'N, 8^0 08.023'E
Buchholzia coriacea Engler	Cappariaceae	wonderful kola	Seed	Oral/Topical	7^0 56.456'N, 8^0 02.196' E
Byrsocarpus coccineus Thonn. ex Schumach.	Connaraceae	*inyankpechi,*	Leaf	Oral/Topical	7^0 18.109'N, 8^0 02.197' E
Ceiba pentandra (L.) Gaertn	Malvaceae	*afu digrima*	Leaf	Topical	7^0 06.640'N, 8^0 05.690'E
Cnestis palala (Lour.) Merr.	Connaraceae	*Ikrinyin*	Leaf	Oral/Topical	7^0 18.203'N, 8^0 02.211'E
Detarium microcarpum Guill. & Perr.	Fabaceae	*Afiogbe*	Root	Topical	7^0 03.172'N, 8^0 05.946'E
Entada abyssinica Steud. ex A. Rich.	Fabaceae	*Aila*	Leaf	Oral/Topical	7^0 18.115'N, 8^0 02.197'E
Erythrina senegalensis DC.	Fabaceae	*Acheche*	Root	Oral/Topical	7^0 04.163'N, 8^0 06.627'E
Gossypium barbadense L.	Malvaceae	*Owu*	Leaf	Topical	7^0 05.159'N, 8^0 05.776'E
Lophira alata Banks ex Gaertn.	Ochnaceae	*Okopi*	Leaf	Oral/Topical	7^0 04.685'N, 8^0 05.892'E
Morinda lucida Benth.	Rubiaceae	*Orgle*	Leaf	Oral/Topical	7^0 08.240'N, 7^0 39.266'E
Nicotiana tabacum L	Solanaceae	*Utaba*	Leaf	Oral/Topical	6^0 56.616'N, 8^0 02.199'E
Olax subscorpioidea Oliver	Olacaceae	*Ochenja*	Root/Bark	Oral/Topical	7^0 03.155'N, 7^0 35.257'E
Piliostigma thonningii (Schum.) Milne-Redh	Fabaceae	*Obleigbo*	Leaf	Oral	7^0 30.531'N, 7^0 55.337' E
Tinospora cordifolia (Willd.) Mier	Menispermaceae	*Ogere*	Leaf	Oral/Topical	7^0 31.856'N, 7^0 59.523'E
Lonchocarpus cyanescens (Schum. & Thonn) Benth.	Fabaceae	*Ufu*	Root	Topical	7^0 08.247'N, 7^0 39.269'E
Annona senegalensis	Annonaceae	*Unwu*	Leaf/Root/Seed	Oral/Topical	7^0 31.912'N, 7^0 58.834'E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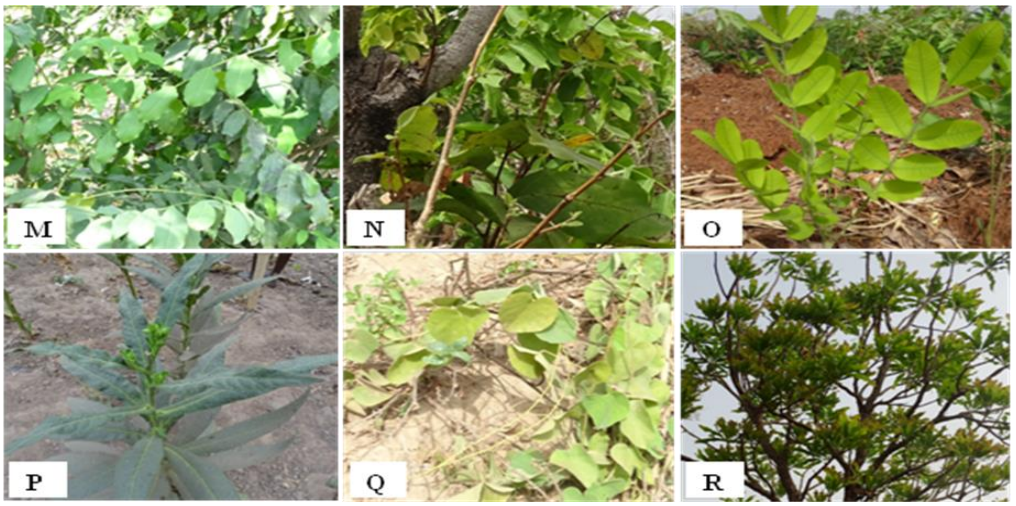

PLATE 1: Medicinal plants used in treating snakebite in Benue, Nigeria (A – R)

A =*Byrsocarpus coccineus*	**G** = *Erythrina senegalensis*	**M** =*Olax subscorpioidea*
B =*Buchholzia coriacea*	**H** = *Cnestis palala*	**N** = *Annona senegalensis*
C = *Gossypium barbadense*	**I** = *Ceiba pentandra*	**O** =*Detarium microcarpum*
D = *Entada abyssinica*	**J** = *Piliostigma thonningii*	**P** = *Nicotiana tabacum*
E =*Anthocleista vogelii*	**K** = *Morinda lucida*	**Q** =*Tinospora cordifolia*
F=*Lonchocarpus cyanescens*	**L** =*Annona senegalensis*	**R** = *Lophira alata*

Plant resources have contributed to primary human needs like human and animal health care especially in tropical countries with little or no access to modern health services (Ekor, 2014). Snakes are poikilothermic (cold-blooded) vertebrates that are more active in warm months and these months are when they reproduce (Ebrahimi *et al.*, 2018). In Nigeria, the warm season corresponds to the months of April-October and this corresponds to the months with highest incidence of snakebite in this study. This is also the season when intense farming activities of planting and harvesting take place and this agrees with previous findings of Sakajiki *et al.* (2017). The demography of our respondents indicated that men have more knowledge than women for treating snakebites, as do older informants. The former could be due to more involvement of men in farming and firewood collection from the wild, whereas the latter could be a result of accumulated experience practicing traditional treatments. The highest proportions of the victims of snakebites were farmers and the incidence of snakebites is attributed to occupational exposure; this corroborates earlier report by Aghahowa & Ogbevoen (2017).

For the medicinal plants used as anti-venom, 18 species belonging to 11 families were documented in this study. Most utilized plant part recorded was the

leaves and this is similar to the findings of Kuntal (2009). Similarly, most of the plants were administered topically; this is congruent with findings in India on anti-venomous plants (Gomes *et al.*, 2010). Some of the plants encountered including *Annona senegalensis*, *A. reticulata*, *P. thonningii*, *D. microcarpum*, *C. pentandra* and *G. barbadense* have been reported to have anti snake venom activity (Bethwell & Daniel 2006; Abhijit & Jitendra 2012). Also the root and leaf of *P. thonningii* and the latex, bark and root of *Anthocleista vogelii* have been reported to neutralize the venoms of *Naja nigricollis* and *Echis ocellatus* in Nigeria (Kwaji *et al.*, 2010; Kutama *et al.*, 2015). Most species in the family of Capparidaceae have been used for the treatment of snakebites (Chinedu *et al.*, 2012) while the root decoction of *Erythrina senegalensis* (Adiaratou, 2008) and *Entada abyssinica* (Marthe *et al.*, 2014) were respectively used as antidotes for snake bite. The preference for the utilization of herbs for treating snakebites might be due to the fact that herbs are available everywhere and easy to collect as compared with other growth forms. Overall, the results from our study contribute to identify potentially effective herbal remedies to treat snakebites and we recommend further phytochemical validation and pharmacological analyses for these species.

CONCLUSION

Snakebite continues to be a major health hazard worldwide. Nigeria is no exception with anti-venom unavailability being the norm and other deficiencies affecting snakebites treatment strategies. Having promising alternative sources at hand, the responsibility to discover, domesticate and culture herbs with anti-venom serum activity for the alleviation of human suffering and death against snakebite is expedient. This study contributes to efforts of gathering ethnobotanical knowledge about snakebites in under-documented areas that may contribute to phytochemical investigations of the active principles and pharmacological properties for the therapeutics of snakebite. Our work paves the way for future research towards isolating active compounds and determining their mechanism of action, biochemical and physiological effects of these plants.

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