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Medicinal plants used to treat Snake bite by Fulani Herdsmen in Taraba State, Nigeria

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Abstract

Snake bite remains a public health hazard in tropical countries. Taraba State with a high Fulani population has one of the highest incidences in the country. The Fulani herdsmen are more at risk because of their agropastoralist lifestyle. Their village settlement positions make it more difficult for them to assess antiserum, the only source of treatment available for snake bite, Therefore the only option left for them is the use of village surrounding medicinal plants for the treatment of the snake bite. Recent efforts on ethnopharmacology revealed several of these medicinal plants with potential to treat snake bite. This work was designed to document medicinal plants used by Fulani herdsmen in Taraba State, Nigeria, for the treatment of snake bites. Information provided will enable further study on the efficacy of the medicinal plants so identified. Eight out of the total sixteen Local government areas (LGAs) of Taraba State, Nigeria were selected for the survey. Sixty four (64) herdsmen with good ethnomedical knowledge were interviewed. The results showed that 19 plants species belonging to 15 plant families were used as remedies for the treatment of snake bite by 42.20% of the Fulani herdsmen interviewed. Annona senegalensis was the most frequently used plant. The proposed mechanisms of action of these plants with regards to venom enzymes inhibition or neutralization were discussed. Further studies on the efficacy and toxicity of these plants are suggested.

Keywords: Antisnake, Venom, Agropastoralist, Ethnopharmacology, Fulani, Taraba State.

Introduction

Snakebites cause considerable morbidity and mortality worldwide with the highest burden found in South Asia and Sub-Saharan Africa (Kasturiratne *et al.*, 2008). The annual incidence of snakebites worldwide is about 5 million with about 100, 000 to 200, 000 deaths (Chippaux, 1998; Cheng and Winkel, 2001). Taraba State has an annual incidence of 40.4 bites per 100000, which is one of the highest in the country (Ekwere *et al.*, 2010). In addition to the deaths, there are an estimated 400 000 snakebite-related amputations each year around the world (Tchoua *et al.*, 2002; Abubakar *et al.*, 2010) with associated tetanus cases (Habib, 2003). Analysis of mortality data suggests that snakebite contributes to 35% of all child deaths, globally (WHO, 2008).

Incidences of snakebites are common among farmers and cattle rearers (Adaudi and Adeyanju, 1989). Bites occur more often while victims are farming, herding or walking; although, the spitting cobra may bite victims who rolled upon the cobra in their sleep (Habib, 2003). In Northern part of Nigeria, cases are higher, especially in the hot-dry seasons between the months of March to September (Ismaila and Adamu, 2012). Snake bite is primarily a problem of the poorer rural populations; there is strong association between snakebite-induced mortality and poverty, (Robert *et al.,* 2004). Poor access to health services in these settings and, in some instances, scarcity of anti-venom, often leads to poor outcomes and considerable morbidity and mortality and the cost of treatment.

Snakebites continue to remain a neglected health problem. The World Health Organization (WHO) has now officially classified snakebite as a neglected tropical disease (http:// www. who. int/ neglec...). Snake envenoming kills more people in the tropics than some of the world's recognized neglected tropical diseases (NTDs), including schistosomiasis and leishmaniasis (Roberts *et al.,* 2004). Despite high numbers of snakebites in Africa, there has been a decline in production, loss of product confidence and under-utilization of trusted life-saving anti-venom products. Good quality anti-venoms made by proven, long-established manufacturers have sadly become unaffordable to all except a few.

Current doses require multiple vials to be effective, rather than an efficacious single vial dose, and with the cost of a 5-vial starting dose of one of these products costing USD $800-1,000, it is apparent that access to effective treatment is beyond the means of poor- rural Africans (Lalloo, 2009). Apart from high cost and availability, the problem of allergy is a challenge in the use of anti-venoms. Envenomation by snake bite is a complex phenomenon and often a life-threatening condition that requires an immediate and effective medical attention.

Some medicinal plants have demonstrated anti-venom properties in preliminary investigations, thus making plants one of the strategic solutions to this neglected disease. Four families of venomous snakes are found in Nigeria--Viperidae, Elapidae, Columbridae and Actraspididae but three species; carpet viper (*Echis ocellatus*), black-necked spitting cobra (*Naja nigricollis*) and puff adder (*Bitis arietans*), belonging to the first two families, are the most important snakes associated with envenoming in Nigeria. *Echis ocellatus* accounts for 66 percent of the bites (Habib *et al.,* 2003). Only 15% of the 3000 snake species found worldwide are considered dangerous to human (Gold *et al.,* 2002; Kasturiratne et *al.,* 2008). Most snake bites are innocuous and are delivered by non poisonous snakes. Viperidae are the largest family of venomous snakes and are found in Africa, Europe, Asia and the Americas (Omogbai *et al.,* 2002). Common among them in Nigeria is the carpet viper which is seen everywhere but highest in the Middle Belt particularly Plateau, Gombe, Bauchi, Kwara, Kogi, Kaduna and Taraba States as well as some parts of Northern Enugu. Gombe has the highest followed by Taraba and Plateau respectively. (Mustapha, 2003).The major groups of snakes causing envenoming are the elapids (cobras, kraits, mambas etc.) and vipers, and in some regions, sea snakes. Snake venoms are complex mixture of enzymatic and toxic proteins, which include phospholipase A_2 (PLA_2), myotoxins, hemorrhagic metallo-proteineases and other proteolytic enzymes, coagulant components, cardiotoxins, cytotoxins and neurotoxins (Kini, 1997; Aird, 2000; Soares *et al.,* 2002). The composition and effects of venom varies considerably between species to species with each having distinct characteristic features as highlighted below.

Fasciculins: These toxins attack cholinergic neurons by destroying acetylcholinesterase, acetylcholine (ACH) cannot be broken down and stays in the receptor. This causes tetany which can lead to death. Fasciculins are found in Black mamba snakes (Warrell, 2003).

Dendrotoxins: Inhibit neurotrans-mission by blocking exchange of + and – ions across the neuronal membrane, sequel to which is inhibition of the neurotransmission, leading to paralysis of the nerves. An example is the Black mamba (Warrell, 2003).

Alpha-neurotoxins: α- neurotoxins bind to acetylcholine receptors at the motor end-plate, they mimic the shape of ACH molecule and fit into the receptors, block ACH flow, leading to numbness and flaccid paralysis (Warrell, 2003).

Phospholipases: Phospholipase A_2 inhibits electron transfer at cytochrome C level and renders mitochondrial-bound enzymes soluble. It damages red blood cells (RBCs), leukocytes, platelets, skeletal muscle, vascular endothelium, peripheral nerve endings, and the myoneural junction (Otten, 1998). Phospholipase A_2 is present in the venom of all families of poisonous snakes (Ahmed *et al*., 2008). Meenatchisundaram et *al*. (2009) demonstrated that *Echis carinatus* venoms have the enzymes (PLA_2) that have the ability to lyse sheep RBCs. Hyaluronidase causes the spread of venom through tissues, while proteolytic enzymes are responsible for the local edema, blistering, and necrosis (Warrell, 2003).

Cardiotoxins: They are muscle toxins that bind to particular sites on the surface of muscle cells causing depolarization, therefore preventing muscle contraction. These toxins are common in Cobra (Mackessy, 2002; Robert *et al.*, 2004).

Haemotoxins: The toxins haemolyse red blood cells. This is common in Vipers and the members of Naja genus (Mackessy, 2002; Robert *et al.*, 2004).

The clinical features of the bites of venomous snakes reflect the effects of these venom components. These include local tissue damage ranging from swelling of the bitten limb to skin and muscle necrosis, abnormal blood clotting and bleeding, hypotension and shock, neurotoxicity which sometimes leads to paralysis of respiratory muscles requiring assisted ventilation, and renal toxicity. Although the most obvious explanation for a confirmed snake-bite with no clinical manifestations is a bite by a non-venomous species, bites by venomous species do not always cause symptoms, and only 50-70% of bites by a venomous species will actually cause envenoming.

Objective

This work was designed to document medicinal plants used for the treatment of snake bites by Fulani herdsmen in Taraba State, Nigeria. Information provided will enable further study on the efficacy of the medicinal plants so identified.

Methodology

Study area

Taraba has sixteen Local Government Areas (LGAs), namely; Ardo Kola, Bali, Donga, Gashaka, Gassol, Ibi, Jalingo, and Karim Lamido. Others are Kurmi, Lau, Sardauna, Takum, Ussa, Wukari, Yorro, and Zing (Ngex, 2013 http:// nnn. com. ng/? page_id=4362).

Taraba State lies largely within the middle of Nigeria and consists of undulating landscape dotted with a few mountainous features. These include the scenic and prominent Mambilla Plateau. The state lies largely within the tropical zone and has a vegetation of low forest in the southern part and grassland in the northern part. The Mambilla Plateau with an altitude of 1,800 meters (6000 ft) above sea level has a temperate climate all year round. With an estimated land area of about 54,428 sq. km, the state lies roughly between latitudes 6°25′N and 9°30′N and between longitudes 9°30′E and 11°45′E. It is bordered in the west by Gombe and Plateau States, and by Adamawa State to the northeast and Benue State in the southwest. An international boundary on the east separates Taraba State from the Republic of Cameroun, (Ngex, 2013 http:// nnn. com. ng/? page_id=4362). It has a population of about 2,688,944 (2005 census report).

Rivers Benue, Donga, Taraba and Ibi are the main rivers in the state. They rise from the Cameroonian mountains, stretching almost the entire length of the state in the North and South direction to link up with the River Niger.

Livestock such as cattle, sheep and goats are reared in large numbers in the region, especially on the Mambilla Plateau, and along the Benue and Taraba valleys. Other livestock production activities like poultry production, rabbit breeding and pig farming are also undertaken, but not in large numbers. The major tribes in Taraba state are Jukun, Mumuye, Chamba, Kuteb, Mambila, Wurkum, Fulani, Ichen, Tiv, Hausa and Ndoro. The high concentration of Fulani herdsmen is due to the vast land and rivers that are essential for the survival of their livestock. They are the major owners of cattle, sheep and goats.

Eight LGAs of Taraba State, Nigeria were selected for the survey. These are Donga, Gashaka, Gassol, Ibi, Kurmi, Sardauna, Takum and Wukari (Figure 1). The choice of these LGAs was because of the high concentration of Fulani herdsmen in these locations. The period of the survey was between September 2012 and January 2013. The choice of Fulanis in the present study was because of their closeness to the plants that endowed them with vast knowledge on ethnomedical potential of these plants (Adekunle *et al.*, 2002). See Figure 1

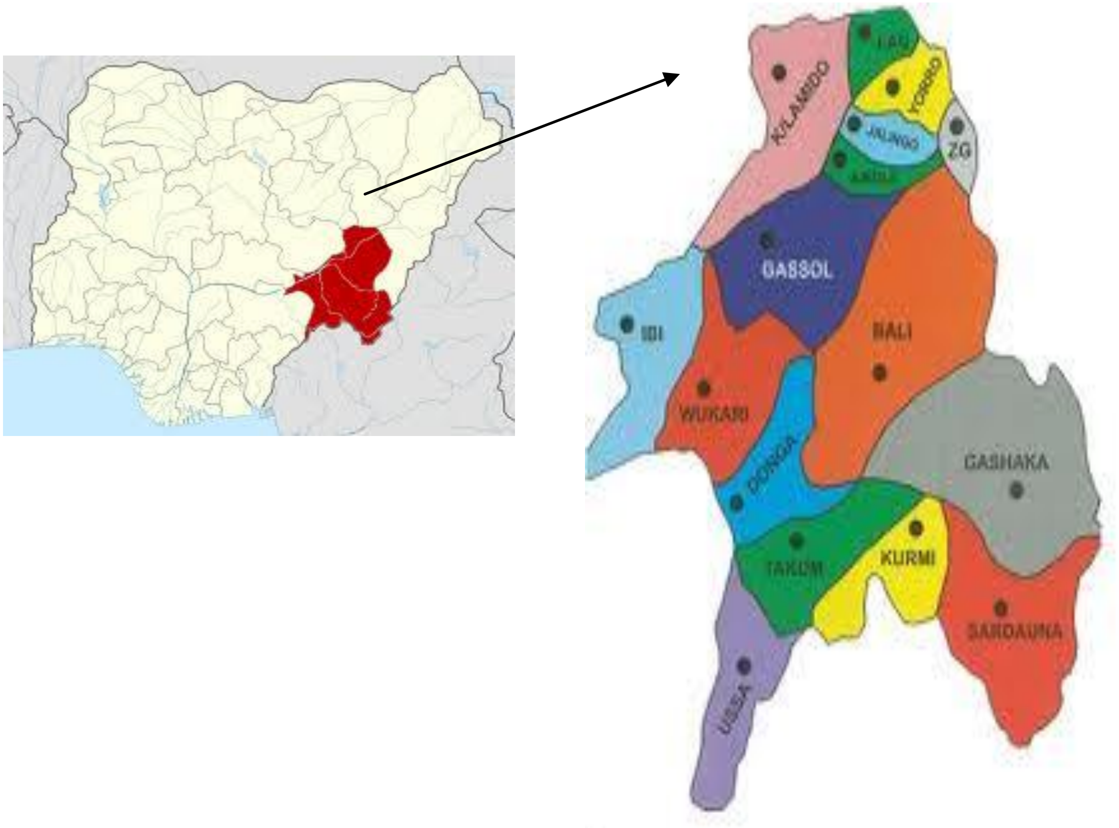

Figure 1: Map of Nigeria showing Taraba State location, and Taraba State showing the all the LGAs including the 8 LGAs in the study area, namely; Donga (1), Kurmi (2), Gashaka (3), Gassol (4), Ibi (5), Sardauna (6), Wukari (7) and Takum (8). (Source: www.ncocusa.com.)

Data collection

Courtesy calls were made to the Fulani chief's (Ardos) with kola (Valued by Fulanis) and introductory letters expressing the purpose of the visit. The Ardos then arranged meetings with the herdsmen. In the meetings, herdsmen vast in ethno-medical knowledge were nominated for the field work. Sixty four herdsmen with good knowledge of medicinal plants from selected locations within the eight Local Government areas were interviewed.

The data were collected using a pre-designed questionnaire with open-ended interviews (Harun *et al*., 2010). The team was made up of two veterinarians, one plant taxonomist, three botanists (One of whom was a Fulani), a microbiologist, a veterinary extension officer (Fulani) and a photographer. The interview was conducted in Hausa and Fulfulde.

The herdsmen that participated in the survey were asked to share their knowledge of snakes, number of snake bite victims they have treated, mode of diagnosis and medicinal plants used by them to manage the bites. A voice recorder was used during interviews with pictures of medicinal plants and parts. Herbarium sample of the medicinal plants and parts used by the respondents were collected and then labeled with their local names, where available. The plants were identified and further authenticated at Department of Botany, University of Lagos and the voucher specimens were preserved in Ethno-botanical survey herbarium, Nigeria Natural Medicine Development Agency, Lagos.

Results

Demographic characteristics of the herdsmen

A total of 64 herdsmen (all Fulanis) were interviewed, they were between 28 and 74 years of age. The percentage age distribution of those interviewed is as follows: 20-30 years (6.3%), 31-40 years (25%), 41 years-above (68.8%) (Table 1). The years of husbandry varied. Also, majority was of Islamic religion and all were married. All the respondents were males with the following educational background; 82.8% had no formal education, 12.5% had an Islamiyya training, 3.1% had a secondary school training while only 1.6% had Higher National Diploma in Animal Husbandry.

Medicinal plants used for treating snake bites

Nineteen plant species belonging to 15 plant families were documented as remedies for the treatment of snake bites by 42.2 % of the Fulani herdsmen interviewed. The details of individual plants and their different parts used are summarized in (Table 2). Members of the Asteraceae, Liliaceae, Malvaceae and Mimosaceae families had the highest number of citation of more than 10% (Figure 2) while *Annona senegalensis* was the most frequent plant species used by 14% of the respondents (Figure 3). *Annona senegalensis* was followed by *Acatia senegalis*, *Aspilia africana*, *Hibiscus scabdariffa* and *Securidaca longepedunculata.*

Table 1: Demographic characteristics of the Fulani herdsmen interviewed in Taraba State to determine medicinal plants for the treatment of snakebites

Respondents characteristics	Frequency	Percentage (%)
Fulani herdsmen age range		
20 – 30	4	6.3
31 – 40	16	25
41 and above	44	68.8
Marital status		
Single	0	0
Married	64	100
Divorce	0	0
Religion		
Islam	62	96.875
Christianity	2	3.125
Traditional	0	0
Atheist	0	0
Years of husbandry		
1 – 5	0	0
6 – 10	11	17.19
More than 10 years	53	82.81
Educational qualification		
Primary school	0	0
Secondary school	2	3.13
Diploma	0	0
Degree/HND	1	1.56
Islamiyya	8	12.50
None	53	82.81

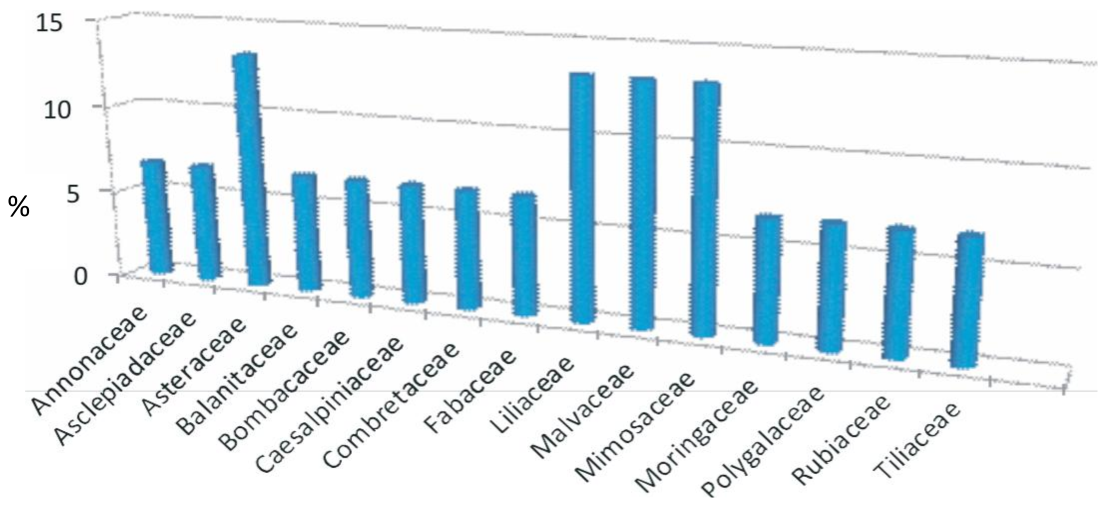

Figure 2: Percentage family distribution of medicinal plants used by Fulani herdsmen in Taraba State, Nigeria to manage snake bites.

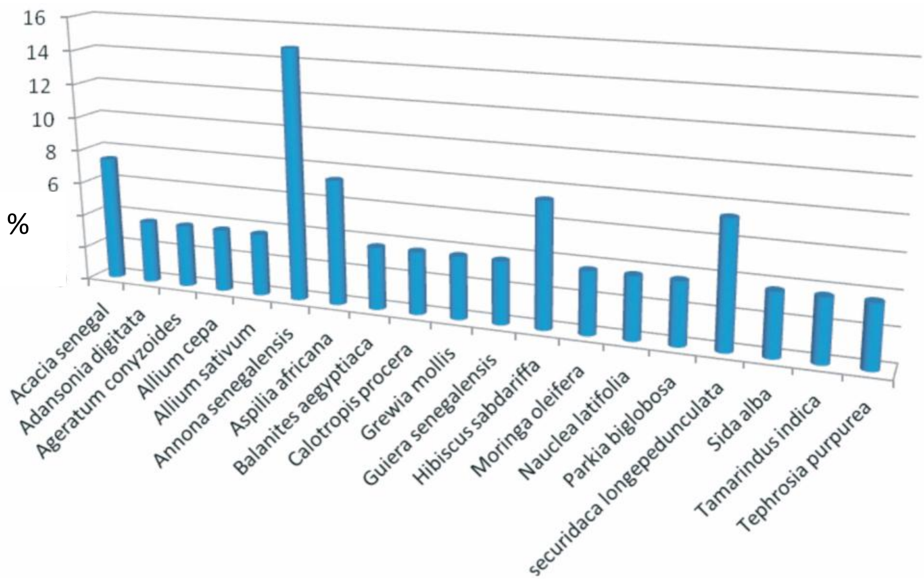

Figure 3: Percentage plant species distribution of medicinal plants used to treat snake bites by Fulani herdsmen in Taraba State, Nigeria.

Table 2: Summary of medicinal plants used by Fulani Herdsmen in Taraba State for the Management of Snake bite

Families	Species	Common names	Local names	Part used
Annonaceae	*Annona senegalensis* Pers	Wild custard apple	H- Gwandan daji; F- Dukuuhi Y-Abo	Root
Asclepidiaceae	*Calotropis procera* (Ait) Ait.f.	Sodom apple	H- Tumfaafiyaa; F-Tumpaapahi Y-Bomu bomu	Leaves
Astereceae	*Ageratum conyzoides* L.	Goat weed	I-Agadi-isi-awo-ocha Y-Ako yunyun	Leaves
Astereceae	*Aspilia africana*(Pers.)C.D.Adams	Hemorrhage plant	H- Kalan wuka; F- Nyarki	Leaves
Balanitaceae	*Balanites aegyptiaca*	Desert date	F- Tanni; H- Aduwaa	Stem bark
Bombacaceae	*Adansonia digitata* L.	Baobab	H- Kuka; F-Bokki	Fruit
Caesalpiniaceae	*Tamarindus indica* L	India date	H- Tsamiyaa; F- Jabbi	Seed
Combretaceae	*Guiera senegalensis* J.F Gmel		H- Saabaraa F- geeloki jelloki	Leaves
Fabaceae	*Parkia biglobosa* (Jacq.)Benth	African locust beans	H-Dooruwa; F-Naree-hi	Stem bark
Fabaceae	*Tephrosia purpurea* (L.) Pers.	Wild indigo Fish poison	H-Maraguwa; F-Jalluri	Leaves
Liliaceae	*Allium cepa*	Onion	H-Albasa; F-Tingyere	Bulb
Liliaceae	*Allium sativum*	Garlic	H- Tafarnuwa; F- arngalaa-re	Bulb
Malvaceae	*Hibiscus sabdariffa* L	Red sorrel	H- Yakuwa F- Follere	Seed
Malvaceae	*Sida alba* L	-	-	Root
Mimosaceae	*Acacia senegal* (L.) Willd	Gum acacia	H-Dakwaraa; F-Dibee-hi	Stem bark
Moringaceae	*Moringa oleifera* Lam	Drumstick tree	H- Zogale; F- Gaware	Seed
Polygalaceae	*Securidaca longipedunculata*	Violet tree	F- aalali	Root
Rubiaceae	*Nauclea latifolia* Sm	African Peach	F- Bakure; I- Ubulinu	Root
Tiliaceae	*Grewia mollis* Juss.		H-Dargaza F-Kelli	Stem bark

H:Hausa, F:Fulfulde, I:Igbo, Y:Yoruba

Discussion

Nineteen plant species belonging to 15 families were identified to be used by the Fulani herdsmen for the treatment of snake bites. Preliminary investigations on the potentials of some plants as antidotes against snake bite have been promising. The extract of the leaves of *Guiera senegalensis* was found to detoxify (*in vitro*) venom from two common northern Nigerian snake species, *Echis carinatus* and *Naja nigricollis*, in separate experiments. There was a remarkable reduction in the mortality of albino mice after intra-peritoneal administration of reconstituted venom incubated with the extract, when compared to those challenged with the venom only (Abubakar *et al.,* 2000).

Luffa aegyptiaca and *Nicotiana rustica* used in traditional medicine to treat snakebites exhibited inhibitory activities on Naja nigricolis venom protease (Ibrahim *et al.,* 2011). The potency of the methanol extract of the root bark of *Annona senegalensis* was tested against cobra (*Naja nigricotlis nigricotlis* Wetch) venom in rats. Results indicated that the extract caused reduction in the induced hyperthermia and directly detoxified the snake venom used by 16–33%. It, however, failed to restore the biochemical functions of serum analine amino transferase (ALT) and aspartate amino transferase (AST) of the liver. The extract exhibited a LD_{50} of 232.7g/ml in the brine shrimp test (Adzu *et al.,* 2004).

The acetone and methanolic stem bark extracts of *Balanites aegyptiaca* exhibited an antivenin activity against *Echis carinatus* viper venom at LD_{50} (0.194 mg/ml), when administered intramuscularly to Wistar albino rats. Both extracts were found to be effective at 75 and 100 mg/ml concentrations (Wufen *et al.,* 2007). Tamarind seed extract inhibited the PLA_2, protease, hyaluronidase, l-amino acid oxidase and 5'-nucleotidase enzyme activities of venom in a dose-dependent manner. The extract neutralized the degradation of the beta chain of human fibrinogen and indirect hemolysis caused by venom. Edema, hemorrhage and myotoxic effects including lethality, induced by venom were neutralized significantly when different doses of the extract were pre-incubated with venom before the assays (Ushanandini *et al.,* 2006).

Di-n-octyl phthalate isolate from *Ceiba pentandra* leaves extract was tested for its anti *Echis ocellatus* venom properties. The isolate was biologically active in inhibiting PLA2 activity in a dose dependent manner (Ibrahim *et al.,* 2011). Both *Indigofera pulchra* and *Aristolochia albida* were found to neutralize the anticoagulant, hemolytic and phospholipase activity of crude venom of *Naja nigricollis* (Abubakar *et al.,* 2006).Aristolochic acid has been found to form a complex with PLA_2, acting as a non-competitive inhibitor of the enzyme(Vishwanath *et al.,* 1987).

The water and methanol extract of *Parkia biglobosa* stem bark significantly protected the chick biventer cervicis muscle preparation from *Naja nigricollis* venom-induced inhibition of neurally evoked twitches when it was added to the bath 3-5 min before or after the venom. The extract also reduced the loss of responses to acetylcholine (ACH), carbachol and potassium chloride (KCl), which are normally blocked by *N. nigricollis* venom. It significantly reduced the contractures of the preparation induced by venom. *P. biglobosa* extract at (75, 150 and 300 µg/ml) significantly protected C2C12 murine muscle cells in culture against the cytotoxic effects of *N. nigricollis* and *E. ocellatus* venoms. *E. ocellatus* completely blocked the hemorrhagic activity of the venom at concentrations of 5 - 10 µg/ml/1.5 microl (Asuzu and Harvey, 2003). The anti-snake venom properties of *S. longipedunculata* root extract have been evaluated in rats by monitoring the levels of the liver enzymes, alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), creatinine kinase (CPK), lactate dehydrogenase (LDH), and amylase. The extract produced a significant dose-dependent alteration in the serum enzymes and urea analyzed. The alterations in these parameters may be responsible for pharmacological activity of the plant extract (Wannang *et al.,* 2005).

The antivenin activity exhibited by some of these plants may justify their use by the Fulani herdsmen. Plant extracts represent an extremely rich source of pharmacologically active compounds and possess more than one biochemical/pharmacological property. Interaction of such compounds with the toxins/enzymes leads to the neutralization and /or inhibition of their activities (Makhija *et al.*, 2010). Studies with combinations of some of these plants may produce better results due to broader venom enzymes inhibition activity. Further studies on the efficacy and toxicity of these plants are suggested.

References

Abubakar, S. B., Habib, A. G. and Mathew, J. (2010). Amputation and disability following snakebite. *Tropical Doctor* 40 (2):114-116.

Abubakar, M. S., Sule, M. L., Pateh, U. U., Abdurahman, E. M., Haruna, A. K. and Jahun, B. M. (2000). *In vitro* snake venom detoxifying action of the leaf extract of *Guiera senegalensis*, *Journal of Ethnopharmacology* 69 (3): 253-257.

Abubakar, M. S., Balogun, E., Abdurahman, E. M., Nok, A. J., Shok, M., Mohammed, A., and Garba, M. (2006). Ethnomedical Treatment of Poisonous Snakebites: Plant Extract Neutralized Naja nigricollis. *Venom.* 44 (5): 343-348.

Adaudi, A. O and Adeyanju, J. B (1989). Snakebites poisoning in Nigerian: Causative snake species and the effects of their venom in Domestic Animal, *Zaria Veterinarian* 4:2.

Adekunle, O. A., Oladele, O. I and Olukaiyega, T. D. (2002). Indigenous control methods for pests and diseases of cattle in Northern Nigeria. *Livestock Research for Rural Development* 14 (2): 1- 4.

Adzu, B., Abubakar, M. S., Izebe, K. S., Akumka, D. D. and Gamaniel, K. S. (2004). Effect of *Annona senegalensis* root bark extracts on *Naja nigricotlis nigricotlis* venom in rats, *Journal of Ethnopharmacology* 96: 507–513.

Ahmed, S. M., Mohib, A., Abu, N., Jyotsna, M., Adarash, C and Jyotishka, P. (2008). Emergency treatment of a snake bite: Pearls from literature. *Journal of Emergency Trauma Shock;* 1 (2): 97-105.

Aird, S. D. (2002) **.** Ophidian envenomation strategies and the role of purines, *Toxicon* 40 (59): 35-393.

Asuzu, I. U and Harvey, A. L. (2003). The antisnake venom activities of *Parkia biglobosa* (Mimosaceae) stem bark extract. *Toxicon* 42(7):763-768.

Census Report. (2005). Population estimates for cities in Nigeria@ 2004-2007 mongabay.com

Cheng, A. C and Winkel, K. D. (2001). Snakebite and antivenoms in the Asia-Pacifi c: wokabaut wantaim, raka hebou ("walking together"). *Medicinal Journal of Australia,* 175:648-651.

Chippaux, J. P. (1998) . Snake-bites: appraisal of the global situation. *Bulletin of the World Health Organization*, 76:515-524

Ekwere, E., Ede, S., Mcneil, R. and Aguiyi, J. (2010). Prevalence of snakebites in Taraba and Plateau States of Nigeria. *Journal of Pharmacy and Bioresources* 7(1):14-19.

Gold, B. S., Richard, C. D. and Robert, A. B (2002). "Bites of venomous snakes". The New *England Journal of Medicine*. 347 (5): 347–56.

Habib, A. G. (2003). Tetanus complicating snakebite in northern Nigeria: Clinical presentation public health implications. *Acta Tropica.* 85(1):87- 91.

Habib, A. G., Gebi, U. I and Onyemelukwe, G. C (2001). Snake bite in Nigeria, *African Journal of Medicine and Medical Science* 30(3):171-8.

Harun-or-Rashid, M. D., Rabiea, T., Khokon, C. G., Rownak, J., Mst.Afsana, K. and Mohammed, R. (2010). An ethnoveterinary survey of medicinal plants used to treat cattle diseases in Birishiri area, Netrakona district, Bangladesh . *Advanced Natural and Applied Science* 4(1):10-13. http://nnn.com.ng/?page_id=4362

Ibrahim, M. A., Aliyu, A. B., Abusufiyanu, A., Bashir, M. and Sallau, A. B. (2011). Inhibition of Naja nigricollis (Reindhardt) venom protease activity by Luffa egyptiaca (Mill) and Nicotiana rustica (Linn) extracts. *Indian Journal of Experimental Biology* 49:552-554.

Ismaila, M. S and Adamu, S. A. (2012). The impact of traditional methods of managing snake bite in humans and livestock among the Hausa-Fulani communities of Sokoto State (North-western Nigeria) *Journal of Medicinal Plants Research* 6(28):4489-4493.

Kasturiratne, A., Wickremasinghe, A. R., de Silva, N., Gunawardena, N. K., Pathmeswaran, A., Premaratna, R., Savioli, L., Lalloo, D. G and de Silva, H. J. (2008). "The Global Burden of Snakebite: A Literature Analysis and Modelling Based on Regional Estimates of Envenoming and Deaths". *In Winkel Ken. PLOS Medicine* 5 (11): e218.

Kini, R. M. (1997). Venom Phospholipase A_2 Enzymes. Structure, Function and Mechanism,Chichester: John Wiley & Sons Ltd., Chichester, United Kingdom, 155–183.

Lalloo, G. (2009). Snake Envenoming: A Disease of Poverty. PLoS Negl *Tropical Disease*. 3(12): e569.

Mackessy, S. P. (2002). "Biochemistry and pharmacology of colubrid snake venoms" Toxin Reviews. *Journal of Toxicology*: 21 (1-2): 43–83.

Makhija, I. K. and Devang, K (2010). Anti-snake venom properties of medicinal plants. *Der Pharmacia Lettre*, 2(5):399- 411.

Meenatchisundaram, S. P. G., Parameswari, T. and Subbrajand, A. M. (2009). Studies on antivenom activity of Andrographis paniculata and Aristolochia indica plant extracts against Echis carinatus venom. *India Journal of Science and Technology* 2:76-79.

Mustapha, S. K. (2003). Snakebites in Gombe, Nigeria.*Highland Medicinal Research Journal* 1(4):22-27.

Ngex. (2013). Taraba State, Nigeria, http://nnn.com.ng/?page_id=4362

Omogbai, E. K. I., Nworgu, Z. A. M., Imhafidon, M. A., Ikpeme, A. A., Ojo, D. O and Nwako C. N. (2002). Snake bite in Nigeria. A study of prevalence and treatment in Benin-city, *Tropical Journal of Pharmaceutical Research* 98:312-315.

Otten, E. J. (1998).Venomous animal injuries. In: Rosen P, Barkin R, editors. Emergency Medicine concepts and clinical practices. New York: Mosby; 924–940.

Robert, A. H., Adam, H., Simon, C. W., Brian, F., David Soares, A M., Fontes, M. R. M and Giglio, J. R (2004). Phospholipases A_2 myotoxins from Bothrops snake review. *Current Organic Chemistry*, 8: 1677–1690.

Tchoua, R., Raouf, A. O., Ogandaga, A., Mouloungui, C., Loussou, J. B., Kombila, M. and Nsafu, D. N. (2002). Analyse des morsures de serpent au Gabon. *Bulletin Soc. Pathology*, 95:188–190.

Ushanandini, S., Nagaraju, S., Harish, K. K., Vedavathi, M., Machiah, D. K. and Kemparaju, K. (2006). The anti-snake venom properties of *Tamarindus indica* seed extract. *Phytotherapy Resourses* 20(10): 851-858.

Viswanath, B. S., Appu Rao, A. G and Gowda, T. V (1987). Interaction of phospholipase A_2 from Vipera russelli venom with aristolochic acid: a circular dichroism study. *Toxicon*. 25:939-946.

Wannang, N. N., Wudil, A. M., Dapar, M. L. P. and Bichi, L. A. (2005). Evaluation of anti-snake venom activity of the aqueous root extract of *Securidaca longipedunculata* in rats. *Journal of Pharmacy and Bioresources.* 2 (2): 80-83.

Warrell, D. A. (2003). Injuries, envenoming, poisoning, and allergic reactions caused by animal. In: Warrell DA, Cox TN, Firth JD, Benj J Jr, editors. Oxford Textbook of Medicine. Oxford: Oxford University Press; 2003. pp. 923–45.

World Health Organization (2008). WHO mortality database: Tables. Geneva, (http://www.who.int/healthinfo/ morttables/en/index.html, accessed 21 April 2008.

Wufen B. M., Adamu H. M., Cham Y. A. and Kela S. L. (2007). Preliminary studies on the antivenin potential and phytochemical analysis of the crude extracts of Balanites aegyptica (Linn.) Delile on albino rats. *Natural Production and Radiance* 6:18-21. www.ncocusa.com.