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Original Article

PREVALENCE OF SNAKEBITES AND USE OF ANTIVENOM PLANTS IN SOUTHERN SIERRA LEONE

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ABSTRACT

In a retrospective study conducted to determine the prevalence of snakebites in villages neighboring a university hospital in southern Sierra Leone, a total of 66 (4.71±2.52) victims reported having been bitten by snakes in 11 out of 14 villages surveyed. More female (2.57±1.38) than male (2.14±1.14) victims were reported, but the difference between the mean number of female and male victims bitten by snakes was not statistically significant (t-test; $P>0.05$). No fatality was reported during the period studied. Only 3 cases of snakebites were recorded by the hospital during the same period, and nearly all victims reported having sought treatment from herbalists despite the close proximity to the hospital. Herbalists indicated utilizing 18 species of plants as anti-venoms, of which *Alchornea cordifolia* (Schum & Thonn) Muell. Arg., *Gouania longipetala* Hemsl., *Cnestis ferruginea* DC, *Rauvolfia vomitoria* Afz, *Elaeis guineensis* Jacq., *Microdesmis keayana* J. Leonard and *Sterculia tragacantha* Lindl, have also been recorded as anti-venom plants in other countries. Future studies should examine the extent of snakebite in other parts of the country and assess the socio-economic implications on victims and their families.

Keywords: *Prevalence, Snakebite, Anti-venom Plants, Sierra Leone*

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Introduction

Snakebites in tropical countries constitute serious socio-economic challenges, but the lack of attention to the problem and the public health implications have been viewed with grave concern (Brown, 2012). Globally, an estimated 1.8 million envenomation lead to 94,000 deaths (Kasturiratne et al., 2008a), with the problem being severe in both Africa and Southeast Asia (Brunda and Sashidhar, 2007). The physical and psychological disability associated with venomous snakebites result in lasting impacts on victims in developing countries where medical infrastructure is poor. Livelihood activities in rural areas bring a large section of the population in contact with snakes, and unattended envenomation may result in fatalities, or serious medical problems that severely impair their physical prowess.

The problem of snakebites as a public health issue in Sierra Leone is not clear, as epidemiological data is lacking for the country (Kasturiratne et al. 2008). Hospital records comprise the main source of information on the incidence and fatality associated with snakebite envenomation worldwide, but generally do not take into account incidences that occur in rural areas (Chippaux, 1998). Minor, and most severe cases of envenomation, are treated by herbalists in rural areas as health facilities may lack antivenom, or victims might find the associated treatment costs prohibitive. According to estimates made by Kasturiratne et al. (2008) utilizing published information, and extrapolated from neighboring countries for Sierra Leone, the estimated number of snakebite envenomings in Sierra Leone was as low as 48 cases and as high as 6,724 cases, and the estimated number of deaths due to snakebite was as low as 1.9 deaths and as high as 470.1 deaths per year.

The clinical complications associated with snakebites can be severe, sometimes resulting in death through asphyxia or hemorrhage. In cases where victims survive such encounters, the consequences can also be grave, with victims potentially unable to use parts of their limbs. This can create dependencies in which victims rely on others to assist them with their daily chores. The social, economic, psychological and health impacts of snakebite burdens worldwide are well noted (Bawaskar, 2004; Chandio et al. 2000; Snow et al. 1994; Chippaux, 2011). The situation for Sierra Leone is not clear, as epidemiological data on the prevalence of snakebites and management of envenomation are difficult to come by. In rural communities, victims may seek alternative treatment measures often provided by herbalists. The main thrust of this study was to document retrospectively, the prevalence of snakebites and use of antivenom plants in managing snakebites in 14 communities in southern Sierra Leone.

Materials and Methods

Data collection was done retrospectively during April–May of 2013 in 14 villages within 10 km of the Njala University campus hospital, in Kori Chiefdom of Moyamba District, southern Sierra Leone. All villages have their own local administrative structures headed by chiefs. Most residents are subsistence farmers, growing rice as the major food crop, but also cultivate pineapples, vegetables or maintain oil palm plantations, while others seek employment with the university due to its proximity.

All villages within a 10 km radius of the university hospital were enumerated, resulting in 14 villages being identified and selected for interviews. Consultation with chiefs and other local authorities in each community was done to acquaint them of the study and consent was sought before commencing the fieldwork. Following this initial introduction, between 12 to 20 persons (including men, women and a herbalist) per community participated in group discussions regarding the extent of snakebites in their community as a way of

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ascertaining the number of people bitten between the period April 2012 – March 2013. Since we were only interested in ascertaining whether anyone had been bitten within the last one year in each community, only information on gender and age (including adult or child) were requested from informants. Any mention of snakebite by group members was crosschecked with the rest of the group, and if further confirmed by family members and or the herbalist, it was recorded as snakebite case to that community. The intention was to reduce errors in the recall of information from the lapse in time from when the incidence occurred. Herbalists were encouraged to provide information on the management of snakebite envenomation, and to collect the plants frequently utilized for proper identification.

Plant specimens were brought to the National Herbarium of Sierra Leone (Njala University), where the curator identified them to species level. A list of plants was compiled and an internet-wide search was done to ascertain the complementarity between the reported antivenom activity and that reported by other studies (Table 2). We used the villages as sampling units to determine the mean number (and standard error) of snakebites for the 14 villages. At the Njala University Hospital, we requested for information on snakebite victims and availability of anti-venom drugs.

Results and Discussion

Prevalence of Snakebites

Of the 14 villages surveyed, 66 (4.71±2.52) victims were reported bitten by snakes, and included 36 female (2.57±1.38) and 30 male (2.14±1.14) victims (Table 1). Even though there were more female than male victims, the difference was not statistically significant (t-test; P>0.05). With the exception of Banbubu, Kawela and Momenga, most villages experienced at least one case of snakebite among the male and female population. All snakebite victims in Pelewahun were female; while in Kamato the victims were all male. The highest prevalence of snakebite was reported in Kotiya (6.67%), followed by Baoma (5.15%) and Bonjema (5.0%). Only one case of severe envenomation was reported resulting in tissue necrosis, and no fatalities were reported across the 14 villages. Hospital records indicated that only 3 cases of snakebites were noted during the study period, and were among those recorded for the village of Mokonde. Even the hospital officers indicated referring victims for specialist treatment in Bo, due to the lack of antisera, the victims were actually treated by a herbalist in the village in which the incidence took place.

Table 1: Prevalence of Snakebites in 14 villages in Kori Chiefdom (Moyamba District) of southern Sierra Leone

Community	Self Reported Populatio	Females bitten by snakes	Males bitten by snakes	Total snakebites	Prevalence (%)
Baoma	97	2	3	5	5.15
Pelewahun	250	4	0	4	1.6
Mosongo	2,000	5	1	6	0.3
Kawela	170	0	0	0	0
Kondibotihun	336	1	3	4	1.19
Foya	350	1	2	3	0.86
Kotiya	150	4	6	10	6.67
Bonganema	500	2	4	6	1.2
Bonjema	400	12	8	20	5
Kamato	49	0	1	1	2.04
Belebu	150	3	1	4	2.67
Banbubu	97	0	0	0	0
Momenga	35	0	0	0	0
Mokonde	5,000	2	1	3	0.06
Total Reported Snakebites		36	30	66	
[1]Mean ± Standard Error		2.57±1.38	2.14±1.14	4.71±2.52	
95% Confidence Limit		(1.19, 3.95)	(1.00, 3.28)	(2.19, 7.23)	

[1]t-test: no significant difference between means of male and female (P>0.05)

The livelihood activities of most people in the villages involve rice farming, the establishment of cash crop plantations and gardening activities, with women playing important roles in the conduct of these activities. In Bonjema and Kotiya, both of which reported higher numbers of snakebites, walking along overgrown footpaths leading to farmlands could have played a role in exposing the

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victims to snakebites. Most snakebite incidences were reported to be higher during the rainy season when footpaths are overgrown, as well as in swamps during periods of intense agricultural activity when both men and women are involved in the preparation of the land for cultivation. In Kotiya, several individuals also own pineapple farms, and it was indicated that snakebites are frequent on such farms especially when the pineapples are ripe for harvesting.

According to Kasturiratne et al. (2008), estimates of the number of snakebite envenomation in Sierra Leone ranged from 48 – 6,724 cases, and the number of deaths ranged from 1.9 – 470.1 persons. These estimates were however based on internet-wide literature search and modeling utilizing regional estimates, rather than actual figures for the country. Given that the majority of snakebites occur in rural communities and victims do not present themselves at public hospitals, reported incidences tend to be underestimated (Chippaux, 1998). In Nigeria, it was estimated that 497 cases of snakebites per 100,000 estimated population occur annually, but that only 8.5% of snakebite victims ever present themselves at the hospital

(Habib et al. 2001). According to an estimate done in 2007 for a population of 148,092,542 persons in Nigeria, only 1,200 cases of snakebites were recorded with 48 fatalities, indicating a lesser estimate when compared to that of Guinea, with a population 15 times less than that of Nigeria (Kasturiratne et al. 2008). Despite the reliance on recall information (with its attendant biases), real time data on the prevalence of snakebites in some rural areas of Sierra Leone is beginning to emerge.

Use of Antivenom Plants

A total of 18 plant species belonging to 14 plant families were reportedly used as anti-venom plants by the herbalists treating snakebites in the 14 villages (Table 2). The plants *Manihot esculenta* Crantz, *Euphorbia prostrata* Ait. F.T.A., and

Table 2: Antivenom Plants Used in the Management of Snakebite Envenomation by Herbalists in Southern Sierra Leone.

Name of Plant	Family	Literature Citation to Anti-Venom Property
Rauvolfia vomitoria Afz.	*Apocynaceae*	*Burkill 1985a; Chifundera 1987; Neuwinger 1996*
Anchomanes difformis Engl.	*Araceae*	
Ananas comosus (Linn) Merr.	*Bromeliaceae*	*Coe and Anderson 2005*
Cnestis ferruginea DC	*Connaraceae*	*Burkill 1985a; Neuwinger 1996*
Tetracera potatoria Afzel	*Dilleniaceae*	
Euphorbia prostrata Ait. F. T. A.	*Euphorbiaceae*	*Mors 1991 [20]; Burkill 1985b [21]*
Alchornea cordifolia (Schum & Thonn) Muell. Arg.	*Euphorbiaceae*	*Burkill 1985a*
Manihot esculentus Crantz	*Euphorbiaceae*	*Kale 2013*
Caesalpinia benthamiana (*Mezoneuron benthamianum* Baill)	*Fabaceae*	*Osho 2014*
Streptogyna crinita P.Beauv	*Graminae*	
Cymbopogon citratus Stapf	*Graminae*	
Vismia guineensis (L) choisy	*Guttiferae*	
Dicrostachys glomerata (Forsk.) Chiav.	*Mimosaceae*	*Chifundera 1987*
Elaeis guineensis Jacq.	*Palmae*	*Burkill 1985a; 1985b*
Microdesmis keayana J. Leonard	*Pandaceae*	*Burkill 1985a; 1985b*
Gouania longipetala Hemsl.	*Rhamnaceae*	*Burkill 1985a; 1985b*
Anisophyllea laurina R. Br ex, Sabine	*Rhizophoraceae*	
Sterculia tragacantha Lindl	*Sterculiaceae*	*Burkill 1985a; 1985b*

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Alchornea cordifolia (Schum & Thonn) Muell. Arg., comprised plants within the Euphorbiaceae with the highest number of species utilized in the management of snakebite envenomation by herbalists. The second most important plant family was Graminae, with *Cymbopogon citratus* Stapf and *Stretogyne crinita* P. Beauv utilized.

Victims of snakebite in the 14 villages are not utilizing the university hospital despite living in close proximity, with local herbalists receiving a large share of the victims. Even though some of the villages were within walking distance of the university hospital, the lack of anti-sera in the hospital is probably forcing victims to seek traditional healers for herbal treatment. The 3 victims from Mokonde village who had sought treatment at the university hospital ended up seeking herbal treatment due to the lack of anti-sera in the hospital. This is not uncommon, as evidence from Nigeria parallels a similar situation (Habib et al. 2001). In Guinea, of 175 snakebite victims, 140 (80%) were reported to have visited a traditional healer to seek treatment while only 2 victims were recorded by clinics within the same vicinity (Baldé et al. 2005a). According to a survey conducted in Sindh, in rural Pakistan, 74.5% of snakebite cases sought treatment from local doctors, while the remaining 25.5% employed other measures (Chandio et al. 2000). In Kenya, it has been reported that approximately 80% of snakebite victims seek the services of traditional practitioners first before visiting a modern medical facility (Snow et al. 1994).

Herbalists indicated the use of plant combinations to manage snakebites depending on the symptoms and the seriousness of the envenomation. *Dicrostachys glomerata* (Forsk.) Chiav., and *Cnestis ferruginea* DC were used in combination; similarly, *Rauvolfia vomitoria* Afz., and *Elaeis guineensis* Jacq., constituted another such combination for treating all types of snakebite envenoming. *Manihot esculanta* was reported by all 14 herbalists as effective for managing the bites of all types of venomous snakes. Among the 18 plants for which herbalists reported as possessing antivenom properties, 12 of these have been reportedly used elsewhere, and the use by herbalists as anti-venom plants is probably new in the ethno-pharmacopoeia of Sierra Leone (Table 2).

The use of anti-venom plants in managing snakebites and envenomation in Sierra Leone is also well noted (Barnish and Samai, 1992; Lebbie and Guries, 1995). Based on assessment of snakebite treatment practices among the Luo of Western Kenya, Owuor et al. (2005) documented the use of 24 plants as antidotes to snakebites. In Zaire, Chifundera (1987) recorded 109 plants utilized in the management of snakebites. The 18 plants noted here as antivenom plants is probably far less than the known antivenom plants in the country, as herbalists with specialized knowledge are generally less willing to share such information (Manvell, 2011; Gupta et al. (2014).

Euphorbia prostrata Ait. F.T.A., has not yet been reported for the management of snakebites in West Africa, but Burkill (1985b) highlights its use in North America for snakebites, and it is reported for the first time in the ethno-pharmacopoeia of Sierra Leone. *Anchomanes difformis* Engl., features extensively in the folk medicine of West Africa, but not as a snakebite remedy, although its usage in Ivory Coast as an antidote to poisoning (Burkill

1985a) could possibly help explain its anti-venom usage in Sierra Leone. According to Burkill (1985a), the leaf and fruit of *Ananas comosus* (Linn) Merr., are utilized in managing spider bites in Sierra Leone, but not in managing snakebites by herbalists. Two plants (*Rauvolfia vomitoria* Afz., and *Cnestis ferruginea* DC) are known to have anti-venom properties (Neuwinger, 1996), and this possibly explains their extensive use in managing envenomation. Burkill (1985a) also notes the plants as antidotes to snakebite envenomation, with *Rauvolfia vomitoria* Afz., used in Nigeria while *Cnestis ferruginea* DC is used in both Senegal and Nigeria as snakebite remedies, but not in combination as observed here in Sierra Leone. In

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Ivory Coast, *Alchornea cordifolia* (Schum & Thonn) Muell. Arg is utilized as an antidote to snakebites, while in Senegal the plant is a venom antidote (Burkill, 1985a). *Gouania longipetala* Hemls., *Microdesmis keayana* J. Leonard, *Sterculia tragacantha* Lindl and *Elaeis guineensis* Jacq., have also featured in the folk medicine of other West African countries as antidotes to venomous bites and stings, and their use by herbalists in Sierra Leone parallels known usage as anti-venom plants (Burkill, 1985a; Burkill, 1985b). Osho (2014) cites the use of a plant (*Caesalpinia benthamiana*), which is regarded as a synonym of *Mezoneuron benthamianum* Baill, for treating snakebites and corroborates its current usage in southern Sierra Leone. Some plant species utilized by herbalists could however not be corroborated by existing scientific knowledge as to their antivenom properties, and this could be a situation where new ethno-pharmacological uses have been developed among herbalists in Sierra Leone that is not known among other local cultures.

CONCLUSION AND RECOMMENDATIONS

Snakebite is an emergency throughout the developing world, and in Sierra Leone where hospital records of snakebites are virtually non-existent, the extent of the problem remains poorly documented. This retrospective study had to rely on memory recall of information from villages,

victims and herbalists to provide an initial understanding of the prevalence of snakebites in the country. Most victims do not seek hospital treatment given the lack of antisera for envenomation, and this is probably a reflection of what obtains nation-wide, as most African countries have seen a decline in their stock of antivenom more recently (Chippaux, 2011). This unavailability is encouraging victims to rely on local herbalists managing cases of snakebite envenomation. Given the lack of information on the prevalence of snakebites throughout the country, there is need for health authorities and researchers to document the extent of the problem, taking into account the impact on the socio-economic lives of victims. There is need to organize for the notification of cases and deaths arising from snakebites, working with local herbalists, clinics, local community leaders and other institutions to develop a clearing house for such information. Moreover, efforts should be made to import and distribute antivenoms for use by hospitals and clinics, while at the same time providing better training for health personnel in their proper use in therapy. Providing information on snakebites and the availability of antivenoms in hospitals and clinics might help to better inform the public about the magnitude and public health implications.

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