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Research Article

Ethnophamacological Survey of Snake Bite Treatment in Ukerewe Island, Tanzania

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Abstract: Snakebites envenomation is an important public health problem in many tropical and subtropical countries and the most affected being farmers, pastoralists, hunters and children. Most of the snakebite morbidity and mortality remain undocumented especially in rural areas since most incidences of snakebite are attended by traditional healers/herbalists mainly by using plants. Pharmacological studies have shown that the extracts and fractions from some of the plants used in traditional medicine are able to antagonize the activity of various crude venoms and purified toxins. Previous ethnopharmacological surveys in Tanzania recorded a number of plants used for snakebite treatment. There is still a large uncovered area of Tanzania where such studies need to be conducted for recording useful medicinal plants. This study was aimed at documenting traditional methods and plants used against snake bites in Ukerewe island as an effort to document useful information. Five Information Providers were face-to-face interviewed guided by semi-structured questions and data recorded in the questionnaire. Nine plant species belonging to eight families were recorded. To our understanding, *Conyza canadensis*, *Ximenia caffra*, *Phaseolus radiate* as well as magnets are reported for first time as antisnake bites. Traditional methods reported in this study are tourniquets and snake stones. Ethnopharmacological studies focusing on plants used against snake bites in the same area and others will facilitate documentation of more useful medicinal plants while scientific verification to confirm efficacy and safety is essential. Furthermore, bioguided isolation of active compounds and or standardization of the drugs are worth doing.
Keywords: Tanzania, Ukerewe island, Plants, Snakebite

INTRODUCTION

Snakebites envenomation is an important public health problem in many tropical and subtropical countries and still difficult to precisely determine epidemiological data due to many unreported cases especially from rural areas. However, it has been estimated that, the incidence of snake envenomation could exceed 5 million per year causing about 125,000 deaths worldwide [1]. There is no country which is free from the risk of snakebite, in some rural areas snakebite is a leading cause of morbidity and mortality among farmers, pastoralists, hunters and children. Snakes such as puff adders (*Bitis arietans*) also injure/kill many domestic animals. Some of the medical manifestations of the snakebite are tetanus, gangrene, cortical necrosis of the kidneys, amputation and disability [2]. Despite snake bite being hazardous, it remained in the category of neglected disease as little attention was given both at national and international levels in developing adequate types and safe antisnake venom drugs [3]. Todate, the only medical treatment available is the use of antisera, developed by Calmette since 1894 [4].

Snake venoms are mainly toxic modified snake saliva consisting of a complex mixture of chemicals and enzymes that are broadly divided in two types namely; neurotoxins, which attack the central nervous system and haemotoxins which target the circulatory system [5]. Snake venom antisera (AVS) uses have limitations that include; high cost and unavailability, inaccessibility for the rural patients, the storage conditions, a short expiry period, restricted application, administration and dosage problems associated hypersensitive reactions which obligates further medical attention [6]. Another drawback of the AVS is the insufficient protection against snake bite as they fail to provide protection against snake venom induced necrosis, renal failure, hemorrhage etc. [7].

Medicinal plants are a rich source of many natural inhibitors and pharmacologically active compounds and plants application against snake bite is known. This natural resource was unexplored until in recent years when it started getting scientific attention as indicated in an array of published ethnopharmacological reviews/articles from different countries reporting many medicinal plants claimed to neutralize the action of snake venom [8,9,10] The *in vitro*/*in vivo* studies have confirmed activity to some of these plants and only a few bioactive compounds identified with less information available regarding to the possible mechanism of action(s) [11-13].

In most developing countries, up to 80% of individuals bitten by snakes first consult traditional

practitioners before visiting a medical centre [14, 15]. In Tanzania the magnitude of suffering caused by the snakebite cannot be estimated due to the poor documentation on both morbidity and mortality cases. This is due to a number of reasons including local logistic problems and many unreported cases occurring in rural/remote areas and victims fully attended by traditional healers.

Although some Tanzanian plants are reported for treatment of snakebite, there had never been a systematic recording of these plants/products. Thus, many plants are yet to be documented especially in unreached places by the previous ethnomedical studies. This work was conducted in Ukerewe island aiming at documenting traditional methods and products used as anti-snake bite as an effort to document useful information.

EXPERIMENTAL SECTION

Study Area

The study was carried out in December, 2012 for the period of ten days covering Nansio and Buhima villages situated in Ukerewe island, Tanzania. Ukerewe has an area of about 530 km² and is the largest island in Lake Victoria and the largest inland island in Africa (figure 1).

Figure 1a: Map of Tanzania [http://www.nationsonline.org/oneworld/map/tanzania-administrative-map.htm]

Figure 1b: Ukerewe island in Lake Victoria, Tanzania [Map data ©2013 Google]

Information collection and Plant identification

Semi-structured face-to-face interview guided by questions set in the questionnaire were conducted with information providers (see Annex). Each information providers was interviewed privately in their homes on different days using both Kerewe (vernacular) and Swahili (national) languages. The data for each mentioned plant was recorded in spaces provided in the questionnaire. The mentioned plants were then collected to prepare the herbaria. Plant identification was done by Senior Botany technicians (Mr. Frank Mbago and Mr. Haji Selemani) at the department of Botany University of Dar Es Salaam.

RESULTS AND DISCUSSION

Ukerewe is an island rich of flora and fauna where part of the population is still bound to traditional beliefs including traditional medicines. Its geographical location, poor infrastructure and social culture factors are among other reasons that made this area less attractive to the ethnopharmacological studies undertaken by the previous teams. Our group has one candidate originating from Ukerewe island. This was advantageous as it facilitated getting reliable data from IPs who consisted of one traditional healer and four knowledgeable people, all male and aged above 50 years. Among them, the traditional healer was more thorough in his explanations and knew all mentioned plants and methods. He was very trusted and dependable in treating snake bites in the study area as indicated by local population.

All IPs were aware of the fact that some snakes are not poisonous. However, despite not being able to identifying the snake, they treat the victims. Since in most cases the biting snakes are not identified and the treatments could be applied on dry snakebites i.e. bites from non-venomous snakes such treatment are either for the wound healing and or provision of activity against pathogenic microbial organisms such as *Clostridium tetani* introduced to the wound from snake's saliva and fangs [16]. The very interesting observation was awareness of all IPs on reporting that, treatment of snake bite needs instant attention as in delayed situations, the medicine they give are likely to be ineffective.

Plants of Ukerewe used against snake bite:

Nine plant species belonging to eight families were recorded as presented in the Table. Dosage forms comprised of seven liquid preparations (decoctions or juice) administered orally and two semi solid (pastes)

applied topically on wounds or incisions. Parts mentioned included leaves, roots, stem seeds and whole plant whose frequency of mentioned is presented in Figure 2. Plants frequency of mention was ranging 60 - 100% indicating on the reliability of information. *Jasminum fluminense* scored 100% followed by *Ximenia cafra* and *Annona senegalensis* each scoring 80%. The values were obtained using the formulae below;

$$Plant\ Frequency\ of\ Mention = (No.\ of\ mentioning\ IPs \div Total\ No.of\ IPs) \times 100$$

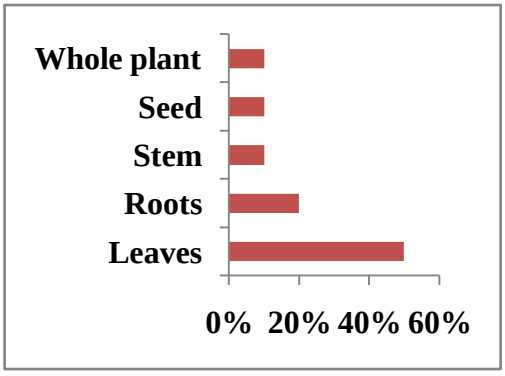

Figure 2: Proportions of plant parts

Table 1: Some Plants Used as Anti Snake Bite in Ukerewe Island - Tanzania

Family and botanical names and Voucher specimen number	**Habit**	**Local name**	**Frequency of mention**	**Plant parts used**	**Method of preparation and adminisration**
Acanthaceae *Crassocephalum manii* (Hook. f.) (UK MAS 08)	Shrub	Mgangogango (Kerewe)	3	Leaves	Leaves decoction is taken orally.
Thunbergia alata Bojer ex Sims (UK MAS 04)	Herb	Nyakatao (Jita, Kerewe)	3	Leaves	Fresh powdered leaves or dried powder is mixed with water to give a paste which is applied in a small incision made in the affected area.
Annonaceae *Annona senegalensis* Pers (UK MAS 06)	Tree	Likonyo (Jita)	4	Stem and Leaves	Decoction of stem and leaves is taken orally.
Asteraceae *Conyza Canadensis* L. Cronq. (UK MAS 03)	Herb	Akamwisanga (Kerewe)	3	Whole plant	Decoction of whole plant is taken orally.
Fabaceae *Phaseolus radiatus* L. (UK MAS 09)	Creeping plants	Ebhisanda (Jita) Choroko (Swahili)	3	Seeds	Powder of seeds mixed with honey then rub to the area after small razor incision.
Malvaceae *Triumfetta rhomboidea* Jacq. (UK MAS 05)	Herb	Kulibha (Kerewe)	3	Leaves	Powdered leaves are tied to the affected site and decoction taken orally only once a day.
Olacaceae *Ximenia cafra* Sond. (UK MAS 07)	Tree	Lisheka (Jita)	4	Roots	Decoction of dried roots is drunk and part of it used to wash the sufferer's cloth.
Olaceae *Jasminum fluminense* Vell.	Climber	Linyafwila (Jita)	3	leaves	Leaves are pounded and compressed in cotton cloth to get the juice which is taken

(UK MAS 01)		Lulebhwa mbusi (Kerewe)			orally twice a day.
Poaceae *Sporobolus pyramidalis* Beauv. (UK MAS 02)	Grass	Chinswi **or** Kurumuzya (Kerewe)	3	Roots	Decoction of roots, taken orally three times a day.

Literature shows that some of the plants recorded in this study have been reported in previous studies although in some cases the phytoorgans, preparation method and route of administration differ. There are also related species used for the same purpose. In case of *Jasminum fluminense* besides leaves, root/root bark are also used. Instant and frequent chewing of leaves is recommended [17, 18, 19]**.** For *Annona senegalensis* either root or leaf paste are applied on the wound and leaves are chewed swallowing the juice [19, 20, 21, 22, 23] Furthermore, the biological testing of the root bark methanol extract of *A. senegalensis* was found to inhibit *Naja nigricotlis nigricotlis* venom induced mortality, toxicity and enzymatic activity in experimental models [24]. In Uganda *Crassocephalum manii* is used against poisoning including snake bites [25] while related species like *Crassocephalum rubens* is used as antidote against any form of poisoning and *Crassocephalum bojeri* reported as antidote to the uspecified poison [18]. In Kenya *Triumfetta rhomboidea* root infusion is applied on the bitten site [21]. The paste of leaves and stems of *Thunbergia alata* is also against snakebite [26].

Regarding *Conyza canadensis*, no antisnake report was found but leaves of *Conyza persicifolia* are used to treat snake bite [18] and the leaf infusion of *Conyza sumatrensis* (Retz) is drunk as an antidote for puff adder (*Bits arietans*) bites [21]. The same applies to *Phaseolus radiates* where *Phaselous mungo* is used for snake-bite and scorpion-sting remedy [17].

Other methods used against snake bite

Tight tying around the limb (tourniquets) followed by incision: The tying is believed to retard the venom spread and the incision in the wound's area is for removing snake's fang and draining the intoxicated blood. Incision practice was in the past accepted but it is nowadays questioned after animal experiment showing that, systemic venom absorption is almost started instantly [27, 28]. Traditional incision procedures are sources of microbial infection. To avoid this, some IPs reported to use salt water and *gongo* i.e. home-made liquor (spirit) illegally consumed in the area for cleaning the wounds. They also believe that, both antivenom and antimicrobial activities are taken care by the topical preparation provided.

The use of snake stones (black stones): A stone is tied against incision made in the wounded area. These snake stone are extremely absorbent and used to draw the venom out of snake bites limiting the venom circulation. The snake stones are either porous minerals stones or porous charcoal prepared from animal and snake bones. The application of snake stone is popular in African and other continents. It bears different names such as; viper's stone, the black stone, or serpent-stone etc. Acceptability of using these stones depends on the experience of the country/community on snake bite injury. Some countries like Peru, each nurse student is obliged to make one stone as a part of the first aid module. As a rule, people working in the plantations should be provided with a black stone [16]. Besides snake bite treatment, black stones highly recommended for use against, scorpions, spiders and other poisonous insects [29]. In Tanzania black stones are sold in market by herbalists or vendors. In rural areas most of families keep stones for emergency use. Despite snake stones remaining popular in various countries the method is not considered effective in modern medicine. Medical studies revealed that, black stone possess no efficacy to treat snake bites [30, 31]. Thus, the benefit of using snake stones is to provide psychotherapy by keeping victim calm and in so doing avoiding the acute stress reaction which increases blood flow and endangering the victims [16] On the other hand, application of snake stone is blamed for contributing to the delay in seeking appropriate medical care, while tourniquets and unnecessary surgical procedures worsen the morbidity [32].

The use of magnets: These are believed to have the ability of immobilizing the snake venoms.

Other useful Information

All IPs referred the term 'a day' as 12 hours and were concerned with age but not weight when determining the amount to given. The duration of medicine intake was 3 to 7 days. They believe that the plants used are not toxic as they have never experienced any problem. Patient's follow up was reported as necessary to monitor the progress and decide if the medicines given are effective. All Information providers were willing to show some of the plants. There is a need to inquire more about the unmentioned plants which may require monetary incentive.

CONCLUSION

Snake bite is a public health problem that does not seem to be alarming since the epidemiological data does not represent the actual prevalence, as many incidences remain unreported. This study is reporting on plants and other methods used to treat snake bite. The use *Conyza canadensis, Ximenia caffra, Phaseolus radiatus* and magnets are reported for the first time while other plants and methods had been documented before. The use of Ximenia caffra however, was not supported by

any plant from the same genus. Plants frequency of mention was 60% or above indicating that, IPs were genuine in revealing the information. Plants reported in this study but untested for antisnake venom activity require scientific verification to confirm efficacy and safety. Furthermore, bioguided isolation of active compounds and or standardization of the drugs are worth doing. The later will be of benefit in rural areas where snake bite is a serious public health hazard.

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