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## Epidemiological Characteristics of Snake-Bite Victims in Gadarif Hospital, Eastern Sudan

<b>Saeed M. Omer</b>	Faculty of Medicine, Gadarif University, Gadarif, Sudan
<b>Mohamed A. Abdallah</b>	Faculty of Medicine, Gadarif University, Gadarif, Sudan
<b>Suad Abdallah</b>	Faculty of Medicine, Gadarif University, Gadarif, Sudan
<b>Khalid M. Ali</b>	Faculty of Medicine, Gadarif University, Gadarif, Sudan
<b>Khalid Eltayeb</b>	Faculty of Medicine, Gadarif University, Gadarif, Sudan
<b>Tajeldin M. Abdalla</b>	Faculty of Medicine, Kassala University, Kassala, Sudan
<b>Gamal K. Adam</b>	Faculty of Medicine, Gadarif University, Gadarif, Sudan
<b>AbdelAzim A. Ali*</b>	Faculty of Medicine, Kassala University, Kassala, Sudan

**Abstract:** This was a prospective cross sectional hospital based study included 117 patients with a definitive history of snake bite and clinical features consistent with the presence of fang marks at the emergency department, Gadarif Hospital, Eastern Sudan from 1st January 2015 to 1st January 2016 to identify the epidemiological factors of snake bite. The majority of these 117 patients were adult (86.3%) and male gender constituted 85.4%. Most of the patients were of rural residence (65.8%) and were involved in farming related activities (68.3%). A relatively high proportion of snake bite episodes happened in the afternoon times (53.9%) and half of the cases were reported during August (18%) and November. (12.8%). Lower limbs were involved in maximum number of the cases (83.7%). The reported systemic reaction included: swelling (100%), sweating (100%), hypotension (54.7%), nausea (51%), vomiting (47.8%), local bleeding (13.6%), hemoptysis (1.7%) and neurotoxic symptoms (0.8%). In this study, there were ten (8.5%) deaths; 7 had grade 3 and the other three patients had grade 4 envenomation. In conclusion Snake bites is a real medical threat in Eastern Sudan; thus, it is very important to educate the native people to increase awareness about the risk of snake bites in particular among male, farmers and during the period from August to November.

**Keywords:** Snake bite, Epidemiology, Mortality, Venom, Sudan.

### 1. Introduction

Snake-bites are well-known as public health problem, medical emergencies and it is highly prevalent in rural areas [1]. It was included in the WHO's list of neglected tropical diseases since 2009 [2]. Snake bite is a real hazard for farmer and resulting many deaths and morbidities [2]. Many species of venomous snakes responsible for these bites are well known [3]. The problem of snake bite is further exacerbated by the cultural beliefs of many rural people such as their attempt to manage the bite using traditional methods [4]. The limited facilities such as poor transportation causing late presentation of the victims; accordingly, it will aggravate deterioration of the condition [4]. The availability of antivenom is a genuine measure to save the victims; however, the production capacity is well below these needs [5]. No doubt this will put the health care providers at a real challenge to deal with snake bites and its consequences. An exact estimation of the incidence of snake bite has not yet been achieved and remains an epidemiological challenge. The epidemiology of snake-bite in the Sudan has not been adequately studied; hence, the present study is directed to investigate the epidemiological characteristics of snake bite in rural and agricultural area in Sudan aiming to provide the programme managers with necessary and fundamental data for intervention and implementation of strategic plan.

## 2. Methods

### 2.1. Study Design and Study Area

This was a prospective cross sectional hospital based study included 117 patients of snake bite at the emergency department, Gadarif Hospital, Eastern Sudan from 1<sup>st</sup> January 2015 to 1<sup>st</sup> January 2016. Gadarif state is one of the most important states in the Sudan; the subject state plays a great role in economical and agricultural activities in the country. It is populated by 1,727,401 residents, covers 75,000 Km<sup>2</sup> and lies at 14°1'N, 35°23'E, 599 m (1965 ft). The average of rainfall is 612 /millimeter. 15°36'N.

### 2.2. Data Collection Method

We included the patients with a definitive history of snake bite and clinical features consistent with the presence of fang marks. Structured questionnaires were used to gather data from the victims to identify the epidemiological factors of snake bite, and no one of the invited patients refused to participate in the study yet. The questionnaire was applied by medical officer in the local language (Arabic) containing sociodemographic data (age, gender & occupation), time of bite and submission (date & month), bite details including anatomic site, clinical finding at the site noted during hospitalization, laboratory results, presenting complaint, systemic symptoms, and outcome of each bite. All patients were approached and managed according to the guidelines for management of snake bite developed by the World Health Organization (WHO). Antivenom was given according to the WHO recommendation and only to patients in whom its benefits are considered likely to exceed its risks [5]. For envenomation, the following grading that were employed by World Health Organization [5] were applied: (I) Grade 0: Fang marks; swelling and erythema around the fang mark <2.5 cm; minimal pain and tenderness; no systemic symptoms, (II) Grade 1: Fang marks; history of immediate pain with the bite; swelling and erythema 5-15 cm; no systemic signs or symptoms, (III) Grade 2: Fang marks; history of immediate severe pain; swelling and erythema 15-40 cm; mild systemic symptoms and/or abnormal laboratory findings, (IV) Grade 3: Fang marks; history of immediate severe pain; swelling and erythema 40; petechiae and bullae; moderate systemic symptoms; bleeding and/or disminated intravascular coagulopathy; abnormal laboratory values, (V) Grade 4: Fang marks; signs of multiple envenomation sites; history of immediate severe pain; severe systemic signs; possibly including coma, shock, bleeding, disminated intravascular coagulopathy and paralysis.

## 3. Ethics

The study protocol was performed according to Helsinki declaration [6] and approved by the Ethical Board committee, Faculty of Medicine, Gadarif University, Sudan. All the data were collected from the participants after obtaining written consent.

## 4. Analysis

Data were entered into a computer database and SPSS software (SPSS Inc., Chicago, IL, USA, version 16.0) and double checked before analysis. Means and proportions for the socio-demographic characteristics were compared between the groups of the study using ANOVA and  $\chi^2$  test, respectively and  $P < 0.05$  was considered significant.

## 5. Results

One hundred and seventeen patients were referred to Gadarif Hospital as victims of snake bite during the study period. The incidence of snake bite episode was 6.8 bites per 100,000 person per year. The majority of these 117 patients were adult; 101 (86.3%) while the rest 16 (13.7%) were children < 15 year of age. The mean age of these snake bite patients was 25.5 (95% CI= 22.4–28.5) years. Male gender constituted 85.4% (100/117) of these patients, with male: female ratio =5.8: 1. Most of the patients were of rural residence (n=77, 65.8%) and were involved in farming related activities (n=80, 68.3%). A relatively high proportion of snake bite episodes happened in the afternoon times (63, 53.9%) followed by morning (28, 23.9%) and night (26, 22.2%) day time. Half of the cases were reported during August (18%) and November (12.8%), [table 1](#).

Most of the patients were brought to the hospital within the first twelve hours of the bite (n=90, 76.9%). Lower limbs were involved in maximum number of the cases (n=98, 83.7%) followed by upper limbs (n=16, 13.7%) and other sites (n=3, 2.6%).

With regard to systemic reaction local swelling, sweating, hypotension, nausea, vomiting, local bleeding, hemoptysis and neurotoxic symptoms (parasthesia, dizziness, muscle fasciculation) were reported in 117 (100%), 117 (100%), 64 (54.7%), 60 (51.2%), 56 (47.8%), 16 (13.6%), 2 (1.7%) and 1 (0.8%) respectively, [figure 1](#). With regards to the grades of envenomation; 27 (23%) victims had grade 0 while 30 (25.6%), 44 (37.6%), 13 (11.1%) and 3 (2.5%) had grade 1, 2, 3 and 4 respectively. In this study there were ten (8.5%) deaths, 7 had grade 3 and the other three patients had grade 4 envenomation.

## 6. Discussion

To our knowledge, this is the first data documenting the characteristics of snake bite in Sudan. The main findings of the current study were; the majority of these patients were adult, with the male gender preponderance. Grade 3 and 4 envenomation were observed in 11.1% and 2.5%, respectively and the mortality rate was 8.5%.

Snake-bite are common events in the subtropical and tropical regions, and have been reported in many countries such as India, Sri Lanka and Latin America, [7, 8]. The rate of snake bites has been reported as 0.33% in Malaysia, and 5.6% in Morocco [9, 10]. According to the World Health Organization (WHO) statistics [11], more than 250,000 victims suffer poisonous snake bites worldwide each year, resulting in almost 125,000 deaths. The incidence of snake bite episode in the current study is 6.8 bites per 100,000 person per year. This finding suggests that an annual incidence density of snake bite is high and need urgent intervention to reduce the risk of snake bites. This can be achieved by the community education on snake-bite and by dissemination of national or local use of guidelines that should be applied when the health care provider deal with the victims. Also availability of antivenom as an essential element of treatment of systemic envenoming will play a major role in fighting the problem. Our study founds 5.8: 1 ratio of male and female snake bite victims. In agreement with our findings male preponderance was also observed in other studies [12, 13]. Males may be at a higher risk than females in developing countries because of their presence in the farms. Furthermore, the highest number of snake bites occurs during the August and November. This happens probably due to most of the agricultural activities take place during this period in Gadarif. Snake bite event occurs mostly when individuals are working or engaging in their activities such as plantation and wood collection. This event explains the highest incidence being at afternoon and morning rather than at night. In agreement with other studies, the majority of the victims in our results (71%) received snake bites in lower extremities, perhaps this occurred because most of the time the snakes were trodden upon by the victims [14]. The reported findings of snake bite in this study included: swelling, hypotension, nausea and vomiting in most of the patients. This finding is in line with what have been reported by [14, 15]. The high fatality rate (8.5%) of snake bite showed by this study may be attributed to low facilities in the setting and unavailability of snake bite antivenom or probably because some of victims were not transferred to the hospital within a reasonable time frame.

One of the major limitation of this study, is its failure to identify the venomous snakes from the non-venomous ones. Many snake-bite victims are treated not in hospitals but by traditional healers and this of no doubt affect the accuracy of our results.

## 7. Conclusions

In conclusion, there is a high incidence rate of snake bite in Eastern Sudan. Snake bites is a real medical threat; thus, it is very important to educate the native people to increase awareness about the risk of snake bites in particular among male, farmers and during the period from August to November. Community education about venomous snakes and snake-bite is strongly recommended as the method most likely to succeed in preventing bites. Snake antivenom provides a specific lifesaving measure; therefore, its availability is mandatory in the setting where there is high incidence rate of snake bite.

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## Competing interests

The authors declare that they have no competing interests.

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**Table-1.** Distribution of snake bites per month in Gadarif hospital, Sudan, 2015-2016

Month	Number	Percentage of the total
January	02	1.7%
February	00	00%
March	04	3.4%
April	08	6.8%
May	06	5.2%
June	11	9.4%
July	11	9.4%
August	21	18%
September	18	15.4%
October	13	11.1%
November	15	12.8%
December	08	6.8%
Total	117	100%

**Figure-1.** Systemic reaction among snake bite victims in Gadarif hospital, Sudan 2015-2016.

