



EXAMINATION OF SNAKEBITE PREVALENCE AND FACTORS PREDISPOSE TO BITE IN LANGTANG NORTH, PLATEAU STATE, NIGERIA

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ABSTRACT

Snakebite poisoning is a public health concern to persons in agrarian environments and Langtang North Local Government Area is not an exception. Agricultural and field workers have been reported to be at higher risk of snakebite in this area. The objective of this paper is to examine the prevalence rate and factors predisposed to snakebite. The primary data was gotten from information drive from questionnaire interview of the respondents (victims) while secondary data was obtained from hospital records at Zamko Comprehensive Health Centre (CHC) and National Population Commission and was analysed by using frequency table and trend line as well as the prevalence rate formula (equation). The results showed that the highest number of snakebites incidence was recorded in 2017 with 117 cases, followed by 2008 and 2018 with 109 cases each. The lowest was recorded in 2014 with 33 cases of snakebites. The result further depicts that the highest number of the snakebite cases was recorded at Zamko ward with 117 cases, followed by Nyer with 100 cases, Lipchok and Kuffen C ward had 78 cases each. The prevalence rate of snakebite cases in Langtang north LGA was found to be 424/100000. The findings of the study shows that majority of the snakebite victims were farmers with 36.23% and was observed from the findings that majority 37.68% of the bites occurred in the morning time as compared to the number in the night with 33.33%. Thus, the major factors found to be associated with snakebites included farming activities, sleeping outside and walking in the night. Community Health Extension Workers should collaborate with ministry of Agriculture to educate people on how to protect themselves from snakebites during farming activities. More anti-Snake Venom Centre or hospital should be provided within each ward to improve accessibility.

Keywords: Antivenom, Langtang North, Plateau State and Snakebites

INTRODUCTION

Snakebites occurred in several parts of the world, especially where poor people are living in rural areas in tropical countries, which the treatment is based on the timely administration of animal-derived antivenoms (Kasturiratne *et al.*, 2008; Harrison *et al.*, 2009). However, a number of factors limit the accessibility to antivenoms in various areas of the world which included relatively high cost of some antivenom in low-income countries (WHO, 2007).

Antivenom, is a medication made from antibodies which are used to treat certain venomous bites and stings. The name "antivenin" comes from the French word venin, meaning venom, which in turn was derived from Latin venenum, meaning poison. The World Health Organization (WHO) in 1981 decided that English words venom and antivenom should be used rather than venin and antivenin or venen and antivenine (WHO, 1981; Dart, 2004). Snakes are distributed throughout most of the earth's surface with some exceptions such as the Arctic, Antarctic, and many small islands where the temperature is low (Chippaux *et al.*, 2007; Habila, 2014). About 85% of Snakebites are caused by non-venomous snakes, and out of 3,000 known species of snakes found worldwide, 15% are considered dangerous to humans (Umar *et al.*, 2015). In 2009, snakebite was finally included in the WHO's list of neglected tropical diseases confirming the experience in many parts of South East Asia region that snakebite is a common occupational hazard of farmers, plantation workers, and others, resulting in tens of thousands of deaths each year and many cases of chronic physical handicap (Gutiérrez *et al.*, 2010).

The prevalence of fatal snakebites in Nigeria should be a cause of worry to the authorities. Data from Nigerian hospitals have shown that out of every 100,000 admissions,

174 cases are from snakebite envenomation (Paramonte, 2007). Recent statistics of snakebites obtained from some medical centres across the country revealed a steady rise with the Kaltungo General Hospital in Gombe and Zamko Comprehensive Health Centre in Langtang North, Plateau State (Ephraims, 2017). The records from the Kaltungo General Hospital showed that between 2005 and 2010, 12,398 snakebites reported with 55 deaths recorded. Many of the victims were from the neighbouring States of Gombe, Bauchi, Taraba and Adamawa State (Ademola-Majekodunmi *et al.*, 2012; Ephraims, 2013; Adamu, 2014). Zamko Comprehensive Health Centre (CHC) reported that in November 2016, 280 cases recorded and the centre has recorded about 1,500 cases of snakebites in the last 10 months of the same year. The number of victims could be higher because most victims visited the herbalists, since they could not afford the anti-snake venom that costs an average of N27, 000 a vial. Some of the main clinical features of envenoming such as systemic haemorrhage, shock, swelling, bleeding have led to amputation, blindness, disability, disfigurement, tissue destruction and trauma in this area (Adamu, 2014; Seriki, 2016). In 2013, two hundred and fifty (250) victims of snakebite died in Plateau and Gombe States as a result of acute scarcity of antivenom drugs in the country, while 744 cases of snakebites out of which 20 lost their lives was recorded in 2015 in Zamko CHC in Langtang North (Nanlong, 2015; Umar *et al.*, 2015).

Faïçal *et al.* (2016), retrospective study of snakebite cases reported to the Moroccan Poison Control Centre between 1999 and 2013 with the aim to describe the epidemiological features of snakebites in Morocco and to evaluate time-space trends in snakebite incidence. The study period showed 2,053 people were bitten by snakes in Morocco. Most victims were

adults (55.4%). The average age of the patients was 26.48±17.25 years. More than half of the cases (58.1%) were males and 75% of snake bites happened in rural areas, and 85 deaths were recorded during this period. Habila (2014) examined factors associated with snakebite and health seeking behaviour among residents of Kaltungo LGA, using structured questionnaire applying multi-stage sampling technique with the aim to identify the factors associated with snakebite and assess the health seeking behaviour among residents. The result showed that Male sex, not attaining educational level up to secondary school level, and Processing Palmyra palm fruits have high risk of snakebite than the female. Sharma *et al.* (2004), conducted a community-based study in south-eastern Nepal, aiming to evaluate the impacts of snakebite and determine the risk factors linked to fatal outcomes and found the most significant risk factors included being bitten inside the house, while sleeping, and/ or being bitten between 12am and 6am, visiting a traditional healer before seeking medical help, and having a lack of transport to medical facilities or delay in obtaining transportation were observed. A study by Ekwere, *et al.* (2010), undertaken to outline the epidemiological profile of snakebites in the middle belt region of Nigeria, using Plateau and Taraba States found records of 917 cases of snakebites from eight secondary health facilities, spread across the two states which were collected retrospectively, covering January 1999 to December 2003. The data was analysed using chi-square test and simple percentages. The results showed that the average male to female preponderance ratio was 2.1:1. Adults between the ages of 15 and 44 years accounted for 62.9% (n=592) of all cases. 41.1% (n=340) of victims were farmers. The average case fatality rate was 13.7% (n=126); with 19.1% (n=64) from Plateau State. The highest incidence of 40.4 bites per 100000 per year occurred in Taraba State. Schneider *et al.* (2021), worked on overview of snakebite in Brazil, possible drivers and a tool for risk mapping to identify higher risk areas for antivenom distribution using data by municipality (2013–2017). An average of 27,120 snakebite cases per year were reported at the country level and Clusters of municipalities with high numbers of snakebites were found in the Amazon Legal Region.

MATERIALS AND METHODS

The study Area

Langtang North Local Government Area (L.G.A.) of Plateau State lies between Latitudes 8°47'00" and 9°18'30"N of the Equator and Longitudes 9°40'00" and 9°56'00"E of the Greenwich Meridian. The town is connected to Shendam, Kanam, Mikang, Kanke, Pankshin, Wase and Langtang South through paved roads. It has the local government secretariat situated at the heart of the town called kuffen.

Study Population.

The study populations consisted of people who have been residing in Langtang North LGA for at least one year and had cases of snakebite. Although, it is possible for an individual arriving Langtang North to be bitten by snake the next day or few days later, for the purpose of this study it will assumed that for one to be sufficiently exposed to snakebite, the individual should have been residing within Langtang North for about one year.

Sample Size and Sampling Technique.

Sample size was calculated using the formula as bellow which was adopted and modified from Habila (2014). This is because it provides a simplified formula for calculating sample Size

$$N = \frac{Z^2pq}{d^2}, \text{ Where } N = \text{Sample size required}$$

Z^2 = Standard normal deviation corresponding to a 2-sided level of significance of 95% = 1.96. p = Prevalence of snakebite was assumed to be 10% = 0.1. q = 1-p = 0.9.

$$d^2 = \text{Desired level of precision of } 5\% = 0.05. \text{ Thus, } N = \frac{Z^2pq}{d^2} = \frac{[(1.96)^2 \times 0.1 \times 0.9]}{(0.05)^2} = 138.2976 = 138$$

The researchers used selective sampling technique firstly to select 9 wards out of 18 wards and secondly, a selective sampling technique to select 15 respondents each from the 9 wards with cases of snakebite for the interview. Finally, the remaining three respondents were selected from the three wards with a less than 15 cases of snakebite. This method was adopted because not all respondents have the same experience or snakebite encounter since there is variation in the strength of snake's venom.

Table 1: Distribution of snakebites and Number of interviewees

Ward	Number of snakebites	Sample
Funyallang	24	-
Jat	26	-
Keller	32	15
Kuffen A	12	1
Kuffen B	16	-
Kuffen C	78	15
Kwallak	23	-
Kwanpe	45	15
Lipchok	78	15
Mban	60	15
Nyer	100	15
Pajat	32	-
Pilgani	78	15
Pishe	12	1
Reak	42	15
Tabat	11	1
Warrok	75	15
Zamko	117	15
Total		138

Source: Compiled from Hospital Record (2021).

RESULTS AND DISCUSSION

In an attempt to determine the prevalence of snakebites in the study area, hospital records for thirteen (13) years from 2007 to 2019 were analysed and the results is presented in Table 2 while subsection presented the prevalence rate and factors that predispose to snakebite that increase prevalence rate within the study area.

Spatio-Temporal Distribution of Snakebite in Langtang North L.G.A

Table 2 shows the reported cases of snakebite across the various wards from 2007 -2019.

A total of 861 reported cases of snakebite incidence were recorded in Langtang North Local Government Area, Plateau State from 2007 to 2019. The result showed that the highest number of snakebites incidence was recorded in 2017 with 117 cases, followed by 2008 and 2018 with 109 cases each. The lowest was recorded in 2014 with 33 cases of snakebites. From the result, is clear that there is an uneven distribution of the snakebite cases between the years, some years recorded higher than some years and this could be attributed to inconsistencies in record keeping and also the availability of anti-venom in the hospital. Failure to report to the hospital

may also be another reason as most snakebites cases are undocumented

The result further depicts that the highest number of the snakebite cases was recorded at Zamko ward with 117 cases, followed by Nyer with 100 cases, Lipchok and Kuffen C ward had 78 cases each while Kuffen A, Pische and Tabat recoded the least number of the snakebites with 12, 12 and 10 respectively. Zamko ward recorded the highest number of snakebites and it could be as result of quick accessibility to the hospital and also could be attributed to the high-level of agricultural activity taking place there and the area is characterized with forest and rocks. Nyer also have high recorded number of snakebite cases and it is noticed to be bordering Zamko ward which implies that residents of Nyer will also have access to the health centre for snakebite treatment. Wards with the lowest recorded cases may have high snakebite incidence but lack access to health facility and will be left with no choice but to patronize the local herbs for their treatment. Also, according to Ismaila and Adamu (2012) in most countries especially in Africa and Asia, majority of the population patronize traditional snake healers in case of snakebites in humans or live stock, since most of these bites occur in areas where anti-venom is difficult to access.

Table 2: Cases of snakebite across the various wards in Langtang North L.G.A. from 2007 -2019

Ward	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Funyallang	3	2	2	1	2	4	0	0	2	1	2	4	1	24
Jat	1	3	0	1	3	2	0	0	4	1	7	3	1	26
Keller	1	1	2	7	4	1	1	0	4	1	6	3	1	32
Kuffen A	2	2	0	0	0	0	1	1	1	1	2	1	1	12
Kwallak	1	4	2	0	1	2	2	0	2	1	0	3	5	23
Kwanpe	0	3	1	8	0	4	3	3	2	2	7	5	8	45
Lipchok	6	8	4	3	6	4	4	1	5	3	13	14	7	78
Mban	2	12	7	4	0	3	3	5	2	3	11	4	4	60
Nyer	7	15	7	9	11	5	4	3	6	5	15	8	5	100
Pajat	3	4	5	1	0	1	3	0	4	2	1	5	3	32
Pil-Gani	0	4	4	2	2	1	3	4	9	5	12	19	13	78
Pishe	0	1	3	0	0	0	3	0	3	0	1	1	0	12
Reak	1	5	2	3	1	1	1	3	5	4	2	6	8	40
Warrok	1	5	5	10	7	3	2	4	5	5	9	9	10	75
Tabat	0	1	1	0	0	2	0	1	3	0	0	2	0	10
Kuffen B	1	4	0	0	0	1	0	0	4	0	4	0	2	16
Zamko	7	27	17	4	6	8	4	3	6	3	17	10	5	117
Kuffen C	5	8	3	2	2	5	5	5	10	3	8	12	10	78
Total	41	109	65	55	45	47	39	33	77	40	117	109	84	861

Source: Author's Compilation, (2021)

Prevalence Rate of Snakebite within the Study Area.

The prevalence rate (P) of a disease refers to any measures of disease frequency. The prevalence was calculated as below using the adopted formula from Elandt-Johnson and Johnson (1980) and Adobasom-Anane (2018) as follows:

$$\text{Prevalence (P)} = \frac{\text{Number of Cases}}{\text{Number of individuals in the study}}$$

$$\text{Or } P = \frac{\text{Number of people with the disease at a time}}{\text{Number of people in the population at risk at the time}}$$

To get the total population of Langtang North at a particular period, the population projection formula adopted from LUPMIS (2021) was used. The population projection is given by

$$P_t = P_o * (1 + r/100)^t$$

Where, t = number years

P_t = population after t years

P_o = Population at the start

r = growth annual rate (in %) = [(P₁/P_o)^{1/t} - 1] * 100

P₁ = population at the second census period.

Since there are only two census period within the study area that is, 1991 with a total population of 94,707 and 2006 with total population of 142,316.

$$r = [(P_1/P_o)^{1/t} - 1] * 100$$

$$= [(142316/94707)^{1/15} - 1] * 100$$

$$= [(1.503)^{1/15} - 1] * 100$$

$$= [(1.503)^{0.067} - 1] * 100$$

$$= (1.028 - 1) * 100$$

$$= 0.028 * 100$$

$$= 2.768\%$$

Population projection from 2006 to 2019 is given by

$$P_t = P_o * (1 + r/100)^t$$

Now our P_o is 142316 and t is 13 therefore,

$$P_{13} = 142316 * (1 + 2.768/100)^{13}$$

$$= 142316 * (1 + 0.02768)^{13}$$

$$P_{13} = 142316 * 1.426 = 202,958$$

This is the projected population at of 2019.

$$P = \frac{\text{Number of people with the disease at a time}}{\text{Number of people in the population at risk at the time}}$$

Number of people in the population at risk at the time

Number of people with the disease at a time = 861

Number of people in the population at risk at the time = 202958

$$P = \frac{861}{202958} = 0.00424 \quad P = 0.00424 * 100000 = 424/100000$$

The prevalence of snakebite cases in Langtang north LGA is 424/100000 which is higher than that of Adobasom-Anane (2018) who found prevalence of snakebite cases in the Tamale Teaching Hospital as 146/100,000 population. This high prevalence can be understood better by ecological theory which Transer and Le Sueur (2003) explained the diversity of Africa using certain factors such as the political, environmental, poverty, and general low levels of well-being of the majority of the population, climatic conditions, vegetation and biography that cause the prevalence of organisms, such as bacteria, viruses, and worms that are disease causing agents in humans. This explains the variation in factors that favour the growth of disease-causing organism in an area.

Factors that Predispose Individuals to Snakebite

Socio-Demographic Characteristics of the Respondents

The distribution of Snakebite victims by age, gender, marital status and level of education is presented in Table 3.

From the result, majority 42 (30.43%) of the victims were in the age group 25-49 years, followed by the 15-24 years age group 37 (26.81%). The 5-14 years and above 50 years age group both had 27 (19.57%) each. This implies that majority of the reached population in the study area were within the productive ages and it is in line with the result of Ekwere *et al.* (2010), who found that snakebite affected mostly adults between the ages of 15 and 44 years. snakebite among young working class makes snakebite not only an issue of public health concern but also of labour and economic significance or challenges.

Table 3: Demographic information of the respondents

S/N	Range of Age	Frequency	Percentage (%)
1	<1yr	0	0
2	1-4yrs	5	3.62
3	5-14yrs	27	19.57
4	15-24yrs	37	26.81
5	25-49yrs	42	30.43
6	≥50	27	19.57
Total		138	100
Gender			
1	Male	92	68.12
2	Female	46	31.88
Total		138	100
Marital Status			
1	Single	57	42.75
2	Married	53	36.95
3	Divorced	12	8.70
4	Widowed	16	11.59
Total		138	100
Educational Level			
1	Primary	45	33.61
2	Secondary	24	17.39
3	Post-Secondary	16	11.59
4	Quranic School	12	8.70
5	Informal Education	41	29.71
Total		138	100

Source: Author's Compilation, 2021

The results on the sex distribution as shown in Table 3 depicted that majority of the snakebite victims were males 92 (68.12%) while the remaining 46 (31.88%) were females. This result could be a function of questionnaire administration to the snakebite victims because most of the respondents encountered were younger aged household head, who were engaged in outdoor work during the survey period. Result from Table 3 further revealed the marital status of snakebite victims. The single is the majority with 57 (42.75%)

followed by the married 53 (36.95%) while the divorced has the least 12 (8.70%). The result also shows that majority of the respondents had Primary Education 45 (33.61%) while 41 (29.71%) had no formal Education. The result from other researches revealed that those with educational level below secondary school education were nearly twice more likely to be at risk of snakebite, compared to those with at least secondary education (Habila, 2014).

Occupational Risk of Snakebite

Table 4: Distribution of Victims by Occupation

S/N	Occupation	Frequency	Percentage (%)
1	Student	27	19.57
2	Business	23	16.67
3	Government Employee	08	05.80
4	Herdsmen	19	13.77
5	Farmer	50	36.23
6	Snake Charmers	0	0
7	Others	11	7.97

Source: Field Survey, 2021

This sub-section was embarked upon to determine the occupations of the snakebite victims and its risk. The findings of the study shows that majority of the snakebite victims were farmers 50 (36.23%) followed by students accounting for 27 (19.57%) and the individuals involved in business 23 (16.67%). The least was the snake chamber with no case recorded. Adobasom-Anane, (2018) also find out that

agricultural workers were mostly affected to snakebite in his study.

Snakebite Cases by Months of Occurrence

In order to determine the period of the year that is prone to snakebites, the occurrence of snakebite incidents was classified into three months interval (January-March, April-June etc.) and result is presented in Table 5.

Table 5: Monthly Variation of Snakebite among Victims

S/N	Range of Month	Frequency	Percentage (%)
1	January–March	46	33.33
2	April- June	23	16.14
3	July-September	38	27.54
4	October–December	31	22.46

Source: Field Survey, 2021

The result shows that majority of the victims 46 (33.33%) admits that the snakebite incidence occurred between January to March followed by 38 (27.54%) of the victims who agreed that the incident occur between July to September. The monthly variations in the cases of snakebites in the different study location could be as a result in differences in climatic condition and nature of the terrain.

Snakebite Victims by Places where the Reported Snakebites took Place

The research also determined the place where the victims got bitten by the snakes and the result is presented in Table 6.

Table 6: Victims Place of Snakebite

S/N	Place of snakebite	Frequency	Percentage (%)
1	Inside the room	6	4.35
2	Outside within the compound	40	28.99
3	Outside near the compound	17	12.32
4	On the farm	46	33.33
5	In the bush	12	8.70
6	Along footpath	17	12.32
7	Others	0	0

Source: Field Survey, 2021

From Table 6, the result shows that majority of the victims 46 (33.33%) were on the farm when the incident happened, 40 (28.99%) were outside within the compound when they got bitten by snake, 17(12.32%) were outside near the compound

and along footpath when they were bitten by the snake. This study is in line with Adiga and Adiga (2014) that found majority 80% of the snakebite cases occurred outdoors and the 20% indoors.

Table 7: Distribution of the victims by activities involved with at the time of bite

S/N	Activity at time of bite	Frequency	Percentage (%)
1	Farming	33	23.79
2	Rearing of Animals	16	11.59
3	Climbing trees	4	2.90
4	Hunting	12	8.70
5	Walking at night	20	14.49
6	Fetching firewood	12	8.70
7	Sleeping outside	24	17.39
8	Sleeping inside room	8	5.80
9	Playing with Snake	0	0
10	Others	9	6.52

Source: Field Survey, 2021

The result presented in Table 7 showed that 33 (23.79%) were farming at time the snake bit them, about 24 (17.39%) of the victims were sleeping outside at the time of bite. 20 (14.49%) of the victims were walking at night while 16 (11.59%) and 12 (8.70%) of the snakebite victims were rearing animals and fetching firewood respectively at time of bite. According to WHO (2010) the risk of snakebite is strongly associated with occupations such as farming (rice), plantation work (rubber, coffee), herding, hunting, fishing and fish farming, catching and handling snakes for food (in snake restaurants),

Victims Time of Bite

The victim's time of bite was also determined from the survey conducted and the result is shown in Table 8.

Table 8: Distribution of the victims by the time of the bite

S/N	Time of the bite	Frequency	Percentage (%)
1	Morning	52	37.68
2	Afternoon	11	07.97
3	Evening	29	21.01
4	Night	46	33.33

Source: Field Survey, 2021

The result shown in Table 8, it was observed that majority 52 (37.68%) of the bites occurred in the morning time as compared to the number in the night 46 (33.33%), about 29 (21.01%) of the snakebites occurred in the evening while the least time of occurrence of snakebite was in the afternoon.

Personal Practices that are related to Snakebite

This sub-section was used to investigate the personal practice of the victims that resulted to snakebite and the result is shown in Table 9

Table 9: Respondents' Personal practices that are related to snakebite

S/N	Activity	Response	Frequency	Percentage (%)
1	Very early farming while is still dark.	Yes	93	67.39
		No	45	32.61
2	Walking bare footed	Yes	101	73.19
		No	37	26.81
3	Heaping grasses on the farm	Yes	97	70.29
		No	41	29.71
4	Working until dark before leaving the farm	Yes	98	71.01
		NO	40	28.99

Source: Field Survey, 2021

The result of this study in table 9 reveals that majority 101(73.19%) of the victims agreed to have walking bare footed at the time of bite, 98 (71.01) agrees that they were working until darkness before leaving the farm, 97 (70.29%) said heaping grasses on the farm was cause of snakebite, while 93 (67.39%) of the victims agreed that they were involved in very early farming while is still dark.

CONCLUSION

From the emerging result, it is seen that majority of the snakebite victims were farmers and were in their farm when the incident happened which occurred mostly in the morning.

Those affected most are the young and productive age group of 25-49 years 42 (30.43%), followed by the 15-24years age group 37 (26.81%). Majority 46 (33.33%) of the snakebites occurred on the farms during farming activities. Males were found to be more likely to be bitten by snakebites than females. Thus, the major factors found to be associated with snakebites included farming activities, sleeping outside and walking in the night. Community Health Extension Workers should collaborate with ministry of Agriculture to educate people on how to protect themselves from snakebites during farming activities

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