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Incidence of snakebites in the area between Mbandaka and Motongambale in the commune of Mbandaka (Equateur Province), Democratic Republic of the Congo

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ABSTRACT

Introduction
The study attempted to elucidate the problem of the management of snakebites and envenomations in rural areas.

Purpose
It aimed to assess the management of snakebite cases in the liquid space around the town of Mbandaka in the Equateur Province of the Democratic Republic of the Congo.

Methods
The area investigated started from the Moyotu-Iyale villages along the Ruki River, moving on to the Isiya-Limbila villages along the Congo River, and ending in the Bondo-Ngolo-Motongambale villages on the Likelemba River. The survey was conducted during the period January 2019 to December 2020. In addition to doctors in the Mbandaka Health Zone, herbalists, traditional practitioners, households with bite cases, and land chiefs were contacted. The survey required the administration of a questionnaire to those involved in the survey.

Results
According to gender, the percentage of healed persons is 89.23% for men and 89.98% for women. More people with after-effects (6.15%) were recorded among men than among women (4.66%). There were slightly more deaths among women (5.53%) than among men (4.62%). In modern medicine in private health facilities, 57 cases of bites were recorded during the study period. Six of these cases were declared cured (10.53%). 10 cases concerned subjects who had escaped with sequelae, i.e., 17.54%. The low score recorded in the latter cases is justified by the lack of an appropriate protocol for specific cases diagnosed based on modern equipment.

Conclusion
The pathology of snakebite and envenomation is a case of neglected pathology in the province of Equateur, but also, traditional medicine can treat the pathology given the percentage of cures achieved by traditional healers.

INTRODUCTION

Worldwide, the number of snake bites is around 125,000 per year, of which 100,000 occur in Asia, 5,000 in America, and 20,000 in Africa, resulting in one million accidents each year (Mokekola et al., 2022; Chippaux 2002; Chippaux, 2006; Diarra, 2008, Descamps, 2013 and Musset, 2004).

Africa is well known for its venomous animals: scorpions and snakes, such as cobras, mambas, and vipers. In rural areas, farmers, foresters and their families face the risk of encountering venomous scorpions and snakes (Ngbolua, 2021).

Several authors (Ngbolua, 2021; Chippaux, 2002; Bellefleur, & Le Dantec, 2005) state that in Africa, bites are linked to agricultural work, fishing, and hunting, or even to walking. Others (Mokekola et al. 2022; Ngbolua, 2021; Chippaux, 2005; Chippaux & Diallo, 2002; Ilumbe, 2019) state that the majority of victims resort to traditional medicine due to the lack of anti-venom centres.

In the Democratic Republic of the Congo (DRC), particularly in the liquid area of the city of Mbandaka, capital of the province of Equateur, located in the confluence of the Congo River, on the one hand with the Ruki River and on the other hand with the Ikelemba River, which are left-hand tributaries of the Congo River, the riparian communities are excessively victims of snake bites. Several cases of death are regularly recorded each year. Some survivors are marked by severe damage and after-effects, rendering them virtually disabled and undoubtedly vulnerable for life.

However, in these rural areas, in addition to the above facts, most of the populations do not hide their concerns about what they designate as a totemic dimension of the snake in almost all the villages and clans of their biogeographical space. They would assert that the bite, its treatment, and certain envenomations required special attention from tradition, which would automatically link clans, individuals, or family members to their totemic animal.

In this respect, the bites that have occurred among the indigenous populations (Pagey, 1983; Pagey; 1988) would only be the obvious consequence of the breaking of ritual clauses or those relating to cultural prohibitions that the collective memory as well as the different traditional social groups would consequently be obliged to scrupulously respect. This would be a pseudo reason for some indigenous people to refrain from seeking diagnosis and/or treatment by modern medicine (Ilumbe, 2019; Page, 2006; Hulstaert, 1994). Traditional medicine (Ilumbe, 2019; Pagey, 1983; Pagey, 1988; Pagey, 2006) is thus revealed as the power of the spirits bequeathed to traditional practitioners who exercise it by deciphering the hidden representations of the pathology as well as any other influence of a visible and/or invisible nature. From these facts, the bite and envenomations would not fail to embody an indissociable reality that is both physiological and cultural.

It is for some of these cases, which are culturally significant for the members of the community, that many would refrain from seeking diagnosis and treatment by modern medicine (Ilumbe, 2019; Pagey, 2006; Hulstaert; 1994). Traditional medicine is then defined as the medicine of the hazards coming from the spirits, designated in the local dialect by the term 'bilima' (Pagey, 1983; Pagey, 2006) and of the fates afflicted on recalcitrant people who have transgressed the established habits and customs. Traditional medicine is revealed as the power of the spirits bequeathed to traditional practitioners (Ilumbe, 2019; Pagey, 1988) to exercise it by deciphering the hidden representations of pathology and all other influences of a visible and/or invisible nature. Therefore, the pathology of bites and envenomations must be categorised in an indissociable reality that is both physiological and cultural. Our study envisages assessing the incidences of snakebite in this liquid space as well as the prevalence according to the different traditional socio-cultural groups most affected by snakebite as categorized by local traditional legislation.

The study is also concerned with the following aspects:

- Bite statistics in terms of gender
- The available therapeutic needs
- The timing of the peak in terms of seasons
- The differential use of modern and traditional medicine.
- The evaluation of the ethnobotanical use value of the different plant resources involved in medicinal preparations to measure the anthropic hold on these

resources which are exposed to almost degrading logging.

METHODS

Description of the study area

Materials

The surveys considered the different traditional socio-cultural groups most affected by the bite. In addition to traditional healers, health personnel from state and private facilities, households that have been bitten, and some traditional resource persons were consulted.

The different traditional socio-cultural groups most affected by the bite are structured as follows:

i. Man with no special status (**M**): this is any man not in conflict with tradition, married or not at the time of the bite.
ii. Man (**M**) who is married and whose wife is pregnant at the time of the bite, symbolised by (**Mmwp**).
iii. Man with a curse: a man who may or may not be married but is known to be cursed because of outrageous behaviour publicly sanctioned by traditional clan law, symbolised by (**Mc**).
iv. A man with a curse whose wife is pregnant, symbolised by (**Mcwp**).
v. Widowed man who has been purified, symbolised by (Wm)
vi. Unpurified widower: a man who has lost his wife but has not fulfilled the minimum ritual content for her purification, symbolised by (**Uw**).
vii. Male child (**Mc**).
viii. Male child in conflict with tradition (**Mcct**).
ix. Male child with one or both parents in conflict with tradition (**Mcbp**).
x. Female (**F**): this is a naturally created female, who may or may not be married at the time of the bite.
xi. Female (**F**) then legally and traditionally married to a man but pregnant at the time of the bite, symbolised by (**Flt**).
xii. Woman with a curse - woman who may or may not be married but is known to be cursed because of outrageous behaviour publicly sanctioned by traditional clan law, symbolised by (**Wc**).
xiii. Woman with a curse and pregnancy, symbolised by (**Wcp**).
xiv. Widowed woman benefiting from a purification, symbolized by (**Wwb**)
xv. Unpurified widow: a woman who has lost her husband but has not fulfilled the minimum ritual content for her purification, symbolised by (**FVnp**).
xvi. Female child (**Cf**).
xvii. Female child in conflict with tradition (**Fct**).
xviii. Female child with one or both parents in conflict with tradition (**FcPct**).

In addition to the socio-demographic aspects, the various plant and animal resources were inventoried and identified.

Methods

The present retrospective study was conducted through a series of ethnobotanical surveys between 2019 and 2020. The semi-structured interview using a pre-developed questionnaire provided information on the epidemiology of snake bites, their envenomation, and the resources used by traditional healers to treat patients.

The study emphasised the importance of ethnobotanical Use Value (**EV**) as a tool for selecting the most sought-after plants (preferred species). At the end of the surveys, an importance score was given to each species by the respondent. The assessment grid used is:

3 (highly sought-after species),
2 (moderately sought-after species) and
1 (weakly sought-after species).

The calculated **VU** made it possible to identify the number of preferred species that fit into different recipes used for the phytotherapy of the bite. A total of 5 herbalists and 9 traditional practitioners were consulted for knowledge of the use of resources involved in the treatment of bite and envenomation. The information thus obtained was used to calculate the ethnobotanical use value of the plants.

The **EV** was used to identify species with a high use value in the study area. It was used to establish a hierarchy of importance at the species level according to the formula used by Lougbegnon et al. (2015):

$$VU(k) = \frac{\sum Si}{n} \quad (1) \quad or$$

- **:VU(k):** ethnobotanical use value of a species k within a given use category.
- If: usage score assigned by respondent i;
- n: number of respondents for the given use category. The use value of a given species (k), within a given use category, is defined by its average use score within that use category.

Accordingly, the scale used for assessment is:

- **If 1 < VU(k) < 1.50**: the species has a low use value i.e., species K is less threatened.
- **If VU(k) = 1.50**: the species has a use value in the median between a low and a high use value. It is true that, given the progressive degradation of the forest and the galloping demography, there is a risk that the species will fall into the interval between high and low ethnobotanical use value.
- **If 1.50 < VU(k) < 3**: the species has a high use value, i.e., it is subject to excessive exploitation. Otherwise, it is on the way to extinction.

The scientific identification of the species has been partially carried out. Some plants are listed with their vernacular names.

To express their attachment to tradition, all our interviews were conditional on a gesture towards the memory of their forefather: a bottle of palm wine and kola nuts here, a bottle of 'Lotoko' (indigenous alcohol) and symbolic money there, as Ilumbe (2019) testified during a study on the traditional treatment of abscesses in the Bikoro territory.

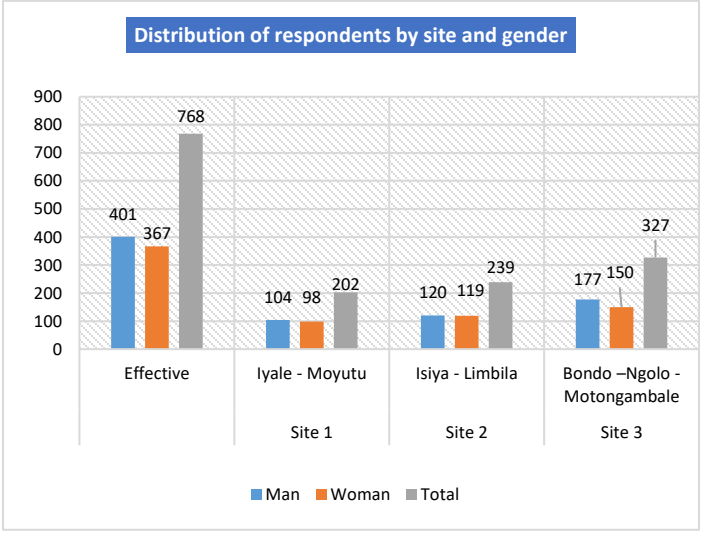
The data collected for the impact assessment was presented in tables, firstly for each site and then in a synoptic table for the whole study area.

Regarding the sample of subjects surveyed, we allowed a larger number of subjects by respecting the criteria established for recruitment. These socio-demographic samples considered the gender, marital, and professional status of the subjects who agreed to take part in the survey.

RESULTS

Distribution of respondents by site and gender

Figure 1:
The informants according to their place of residence and gender



Of the 768 people surveyed in the three sites, 327 of the representative informants (42.58%) were sampled in Site 3 (Bondo-Ngolo-Motongambale). The other two sites had 31.12% (Site 2) and 26.3% (Site 1) respectively.

Distribution of respondents by age group and gender

Figure 2:
Informants' frequency by age and gender

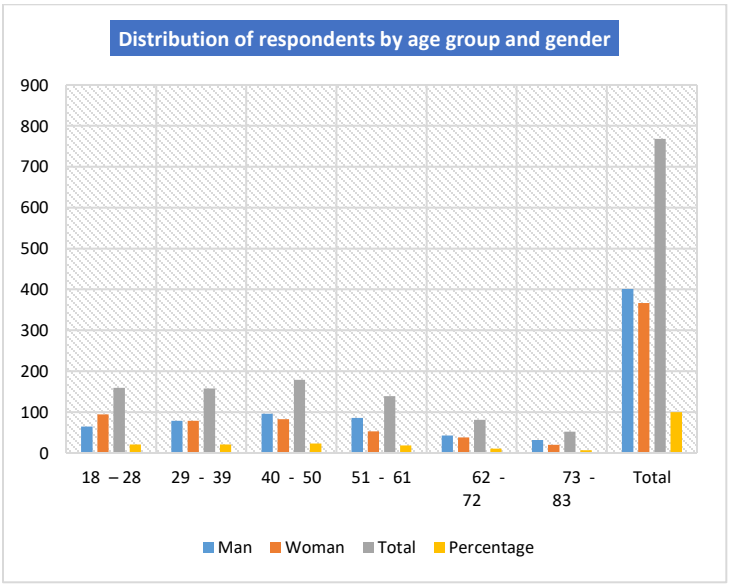


Figure 2 shows the distribution of respondents by age group and gender.

Figure 2 shows that the most dominant age group is those aged 40-50 with 23.31%, followed by those aged 18-28 (20.70%), 29-39 (20.57%), 51-61 (18.10%), 62-72 (10.81%), 73-83 (06.77%).3.

Distribution of respondents by marital status

Figure 3:
Distribution of respondents by marital status.

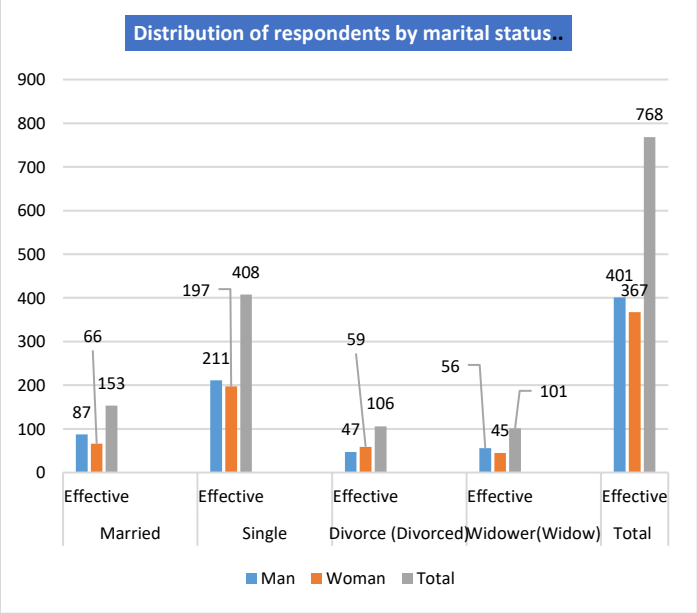
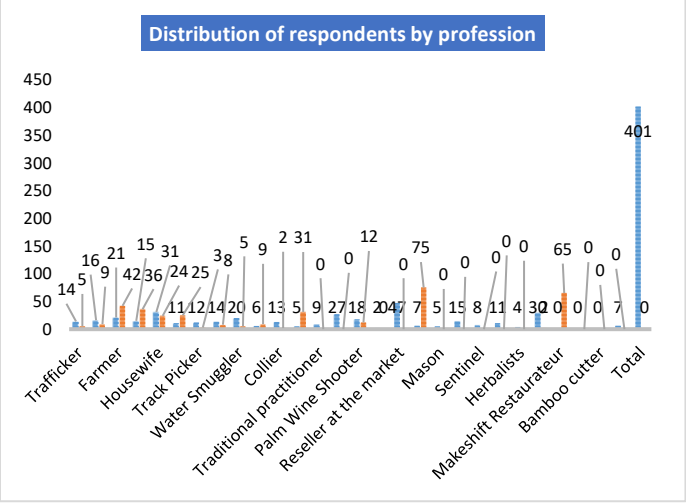


Figure 3 shows that single people represent the largest group of respondents, with 408 subjects, or 53.12%. Married people come next with 153 subjects, or 19.92%.

Distribution of respondents by profession

Figure 4:
Information on the professional status of informants



The sample is dominated by dealers (15.88%) in the various markets in the area, followed by the unemployed (12.37%), students (7.55%), farmers (7.42%), and housewives (7.29%).

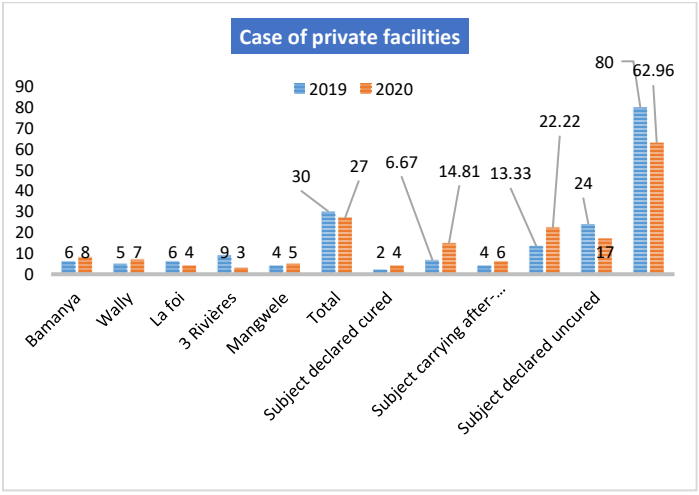
Ethnomedicinal data

Management of envenomation cases

a) Follow-up of cases admitted to medical facilities

- **Case of State Structures**
  The three health zones of Mbandaka, Wangata, and Bolenge do not have statistics on bites and their treatment. Bites and envenomations are not mentioned in the annual reviews of the Provincial Health Division despite the scale of cases in less urbanised and essentially rural areas.
- **Case of private facilities**
  Statistics from some private health facilities are shown in Figure 5.

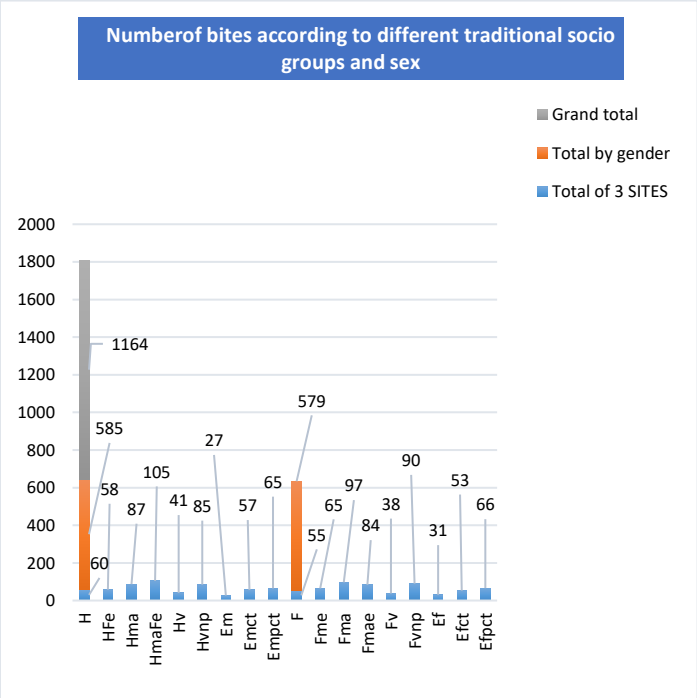
Figure 5:
Number of cured sequelae and non-cured cases at private health centres



In these private health facilities, there were 57 cases of bites during the study period. 6 of these cases were declared cured (10.53%). 10 cases concerned subjects who were discharged with sequelae, i.e., 17.54%. The number of deaths was 41, i.e., 71.93%, which is still a heavy burden in terms of drama.

b) Follow-up of cases treated by traditional healers

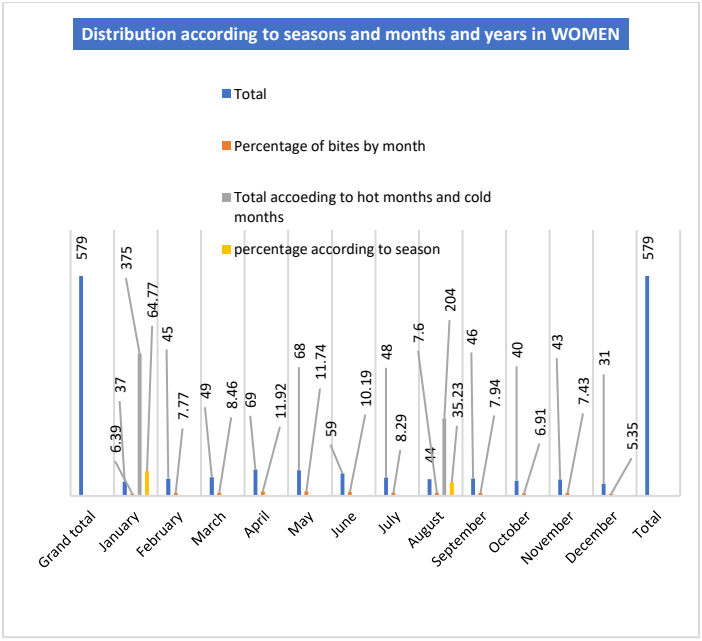
Figure 6:
The number of bite cases by socio-traditional groups in the study area



The data in Figure 6 shows that the main snake bite victims in the study area are HmaFe, Fma, Hma, and Fmae.

In the whole of the Mbandaka liquid area, three sites grouped in this table, the overall sample amounted to 1164 subjects who had been bitten. 585 of these, or 50.26%, were male, and 579, or 49.74%, were female. Regarding the different traditional social groups thus identified, and based on the overall sample, among men, the HmaFe group is present with 105 cases or 9.02% followed by Hma with 87 cases or 7.47%. On the other hand, among women, the Fma group is in the lead with 97 cases, i.e., 8.33%, followed by Fvnp with 90 cases, i.e. 07.73%, and Fmae with 84 cases, i.e. 7.22%. For the category of children, the male gender dominates slightly in the number of bites (122 cases) compared to the female gender (119 cases). When we group the subjects not in conflict with tradition on the one hand and the subjects apparently in conflict with tradition on the other, we see the following: the male subjects not in conflict represent a total of 186 in02.14 bitten individuals and the subjects in conflict represent 399 bitten individuals. On the other hand, among the subjects not in conflict with the female tradition, there are 189 individuals bitten and the subjects in conflict are 390 individuals. The ratio of the number of individuals in conflict with each sex to the number of individuals not in conflict with each sex is slightly higher for men (2.14) than for women (2.06), and the harmful action of snakes on human beings is more intensified in men than in women, at least for the Mbandaka liquid space.

Figure 7:
The distribution of snake bite frequencies according to seasons, months, and years in women



Regarding the overall frequencies recorded in women, the frequencies (69 cases or 11.92%) follow the same rhythm as in men.

In the whole study area, the highest frequencies are recorded in April with 134 cases, i.e., 11.51%. This is the peak month when snakes are very mobile and cause many encounters with humans. It is also the busiest month for farmers to prepare for the next growing season. Similarly, traffickers are in a hurry to evacuate produce from the fields as May is a very rainy month making the agricultural feeder roads much more impassable.

- **Follow-up of cases treated by traditional healers**

Figures 8a and 8b show, respectively, the monitoring of males and females and the total number of males and females admitted for treatment in the entire study area by traditional healers.

Figure 8a:
Tracking of male cases treated by traditional healers

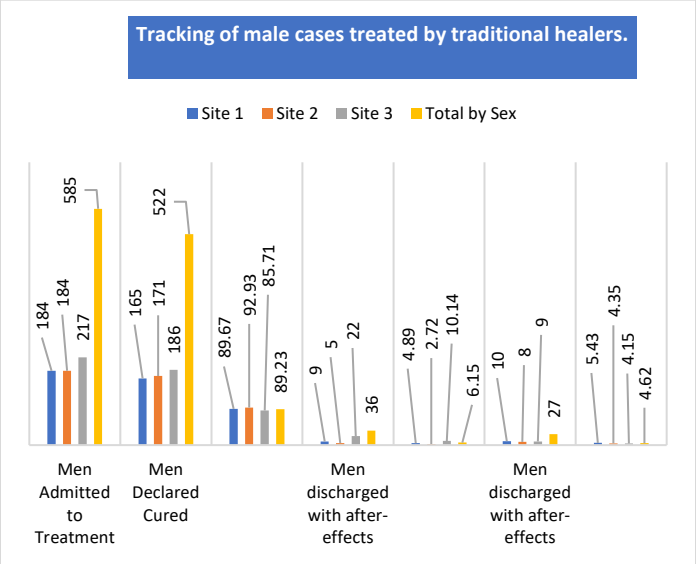


Figure 8a shows the follow-up of men admitted for treatment in the entire study area by traditional healers.

Figure 8b:
Tracking of women cases treated by traditional healers

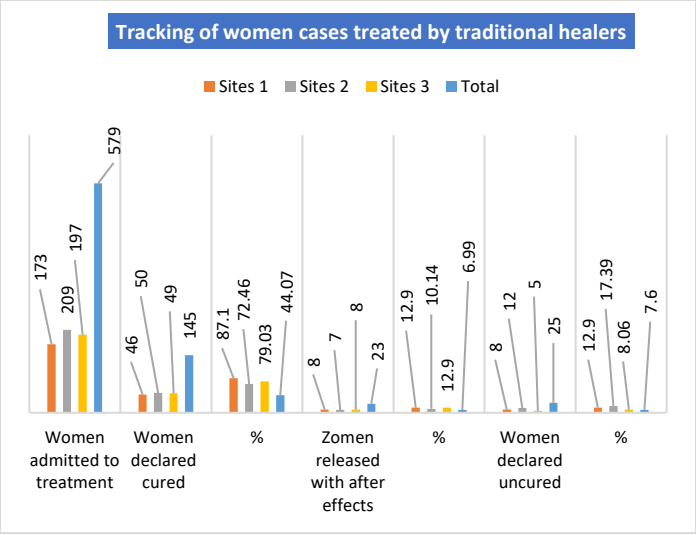
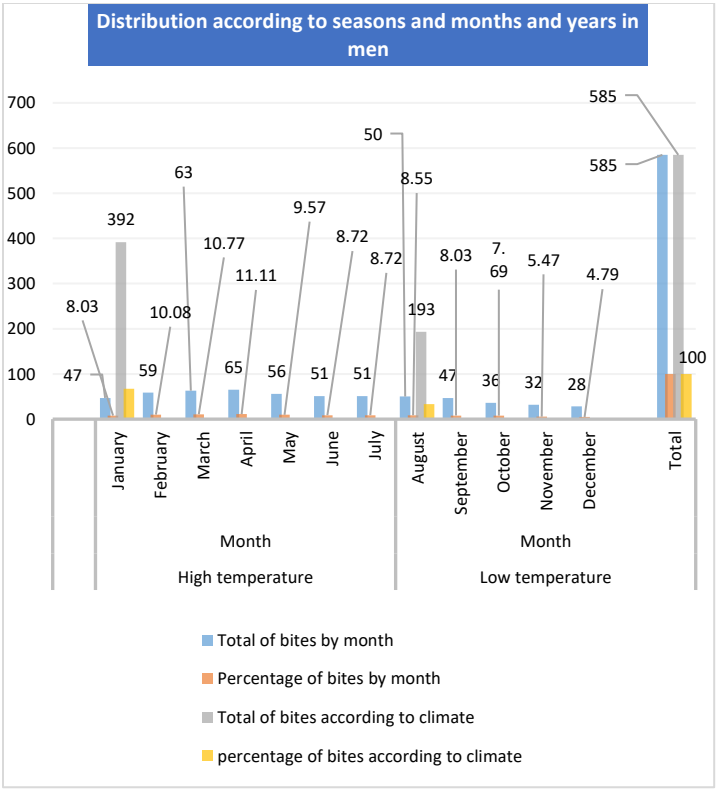


Figure 8b shows the follow-up of women admitted for care in the entire study area to traditional health practitioners.

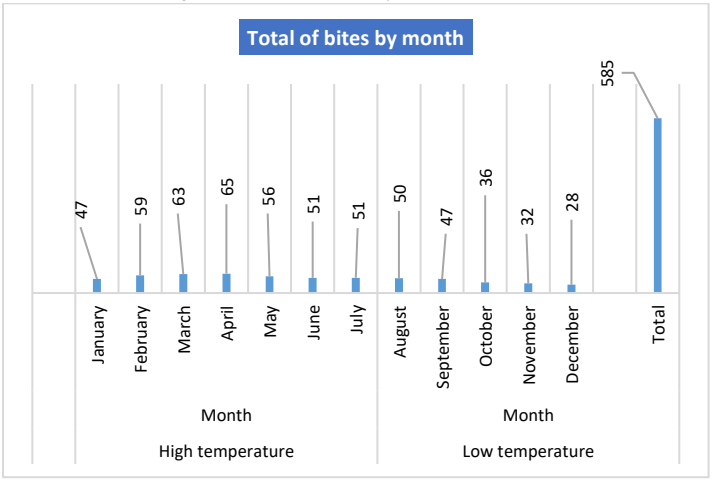
In the whole study area, according to gender, the percentage of cured and healed cases is 89.23% for men and 89.98% for women. Men recorded more cases with sequelae (6.1%) than women (4.66%). A little more women (5.53%) died than men (4.62%). Taking all types together, 89.52% of people were cured, while the number of deaths amounted to 59 people or 5.07%.

Table 9:
Distribution according to seasons and months and years in men



392 cases in periods of extreme heat compared to 193 in moderately cold weather zero recorded. The peak is in April with 65 cases or 12, 31%.

Figure 10:
Distribution according to seasons months and years in women



Floristic diversity of plants used against snakebites

TABLE 1 presents ethnobotanical information on anti-snakebite plants, including their scientific name, vernacular, botanical family, habitat, plant organ, and ethnobotanical use values.

Table 1:
Floristic diversity, Families, organ, relative frequency, ethnobotanical use value

N°	Scientifical name	Vernacular name	Botanical family	Parts used	Relative Citation Frequency (RCF) of medicinal plants			
					Number of citations (n)	FRC calculated	∑ Si	VU
01	***Aframomum citratum*** (J.Pereira) K.Schum.	Mondongo	Zingiberaceae	Fruit, leaf	9	**0.64**	25	**2.78**
02	***Agerantum conyzoïdes*** L.	Ngwaka : Tangbabu, Dagbabu / Libinza : Ngele / Lomongo : Bokatola / Lokonda : Emanda, Lutu lo ntaba / Lonkundo : Likotsi / Budja : Ekbulu / Makutu : Mobondo	Asteraceae	Stem, leaf	14	**1**	37	**2.64**
03	***Allium cepa*** L.	Ndembi	Liliaceae	Leaf	11	**0.78**	25	**2.27**
04	***Aloe vera*** (L.)Burm.f.	Aloe vera		Leaf	9	**0.64**	25	**2.78**
05	***Alostonia congensis*** Engl.	Mokuka (bokuka) / Ngwaka : Denga / Mbanza : Dungunikwa / Kitembo : Mukuka Lomongo : Bokuka	Apocynaceae	Leaf	11	**0.78**	28	**2.54**
06	*Amaranthus* sp.	Bompoko o ngola	Amaranthaceae	Leaf	10	**0.71**	25	**2.50**
07	***Barteria fistulosa*** (Mast.) Sleumer. Synonyme *Barteria nigritana* Hook.f. subsp. fistulosa (Mast.) Sleumer	Bonkokombi (linkokombi) / Ngwaka : Kokombo / Mbanza : Augbekimue / Ngombe : Likokombo / Kisengele : Bonkomo nkomo Lomongo : Bonkonkomo	Passifloraceae	Leaves, bark, root	12	**0.86**	28	**2.33**
08	***Capsicum annuum*** L. Synonyme *C. frutescens* L.	Ngbendu (pilipili) / Mono : Djengete / Lingala : Pilipili / Ngwaka : Tandala / Kuala : Lolo gbendu	Solanaceae	Fruit, leaf	10	**0.71**	24	**2.40**
09	***Certis congensis***	Bololo	Araceae	Leaf	11	**0.78**	28	**2.54**
10	***Citrus medica*** **L.**	Ndimo ngai	Rutaceae	Fruit, root	12	**0.86**	29	**2.42**
11	***Coclocaryon preussi***	Bosaka (ebondo)		Bark	12	**0.86**	32	**2.67**
12	***Cola acuminata*** **(P.Beauv.) Schott & Endl.**	Likasu	Sterculiaceae	Fruit, root	10	**0.71**	29	**2.90**
13	***Costus polycephalus***	Musaso	Zingiberaceae	Leaf, fruit, stem, flower	12	**0.86**	32	**2.67**
14	***Costus afer*** Gawl	Lingala: Monyeza (Bekako) / Lonkundo : Bansanga / Kirega : Malenge mabasumbu Ngwaka : Kanga / Kintandu : Munkeni Ngombe : Ngala kulu	Zingiberaceae	Leaf, fruit, stem, flower	13	**0.93**	33	**2.54**
15	***Costus lucanusianus*** J.Braun & K.Schum.	Lingala : Ngakulu	Zingiberaceae	Stem, leaf, flower	10	**0.71**	24	**2.40**

16	**1. *Lasimorpha senegalensis* Schott**	Mantolo	Araceae	Leaf, rhizome	09	**0.64**	19	**2.11**
17	***Discorea* sp.**	Mbuma yanyoka	Discoreaceae	Fruit, leaf, root	12	**0.86**	31	**2.58**
18	***Elaeis guineensis Jacq.***	Limbila	Aracaceae	Nuts and spongy material on twigs	11	**0.78**	26	**2.36**
19	***Eleusina indica*** (L.) Gaertn	Mpama : Lolongi lo mwelé / Lokonda : Ekoko / Ngwaka : Ndumulu / Kintandu : Kimbansi / Kitembo : Elulu / Libinza : Bakata / Lomongo : Likalabandja Kirega : Ibangubangu	Poaceae	Whole plant	13	**0.93**	32	**2.46**
20	*Erythrophleum suaveolens* (Guill. & Perr.) Brenan	Mbondo bololo (efomi)	Fabaceae	Leaf, bark, root	12	**0.86**	32	**2.67**
21	***Garcinia kola***	Museno (Ngadiadia)	Clusiaceae	Fruit	12	**0.86**	28	**2.33**
22	***Gnetum africanum***	Fumbwa (koko)	Gnetaceae	Leaf, stem	09	**0.64**	22	**2.44**
23	***Hymenocardia sp.***	Ngaingai ya zamba	Malvaceae	Leaf, stem	10	**0.71**	28	**2.80**
24	***Mitragyna stipilosa* Korth.**	Moluku	Rubiaceae	Fruit, leaf	11	**0.78**	27	**2.45**
25	***Morinda morindoides*** (Baker) Milne-Redh.	Ngwaka : Gbozokanga, Buezokongo Ngbandi : Ngonzo konga / Lingala : Kongo bololo / Lokonda : Kongo bololo / Libinza : Kongo bololo / Lonkundo : Kong'ololo Mpama : Ngonga bololo	Rubiaceae	Leaf, stem	13	**0.93**	34	**2.61**
26	***Moringa oleifera* Lam.**	Moringa	Moringaceae	Fruit, leaf, bark, root	9	**0,64**	24	**2,67**
27	***Mucuna pruriens*** (L.) DC.	Likula : Liloso	Fabaceae	leaf, fruit, root				
28	***Musa* sp.**	Likemba	Musaceae	Fruit, dry leaf, dry trunk	10	**0.71**	25	**2.50**
29	***Ocimum bassilicum*** L	Lingala: Lumbalumba / Mono : Anerakola / Kirega : Basenye / Lomongo : Bonsonsole / Bobangi : Nzangasani / Mpama : Monzangasano, Ososolo / Kisengele : Bonsonsolo / Kinunu : Nganga nsali / Tshiluba : Lueny	Lamiaceae	Leaf, stem	14	**1.0**	33	**2.36**
30	***Ocimum gratissimum*** L.	Ngwaka : Ele, Gbaniama / Lingala : Mesosole, Lumbalumba/ Ngombe : Modangba, Mandembu, Mongai/ Lomongo : Bonsonsolo / Lonkundo : Bonsonsole; Mpama : Lumba lumba	Lamiaceae	Leaf, stem	12	**0.86**	31	**2.58**
31	***Palisota schweinfurthii*** C.B.Clarke	Libinza: Litetele: Ngwaka : Zazu, Kpato, Zâzo	Commelinaceae	Leaf, stem	12	**0.86**	30	**2.50**
32	***Phaseolus sp***	Liwa za ndjo	Fabaceae	Fruit, leaf	13	**0.93**	34	**2.61**

33	***Piptadeniastrum africanum*** (Hook.f.) Brenan	Mokungu (bokungu) / Lomongo : Bokungu Ngbandi : Kungu / Ngwaka : Mokungu Lokonda : Bokungu / Mpama : Okungu	Mimosaceae	Bark, root	12	**0.86**	34	**2.83**
34	***Quassia africana*** (Baill.) Baill. (Simaroubaceae)	Lomongo : Yayotomba / Lonkundo : Yola yotomba / Lingala : Ekbetema / Mbole : Ekbetema	Simarubaceae	Root, leaf, stem bark	11	**0.78**	28	**2.54**
35	***Sansevieria liberica*** Gérôme & Labroy	Lomongo : Fulele ya lokoto Nom vulgaire : Sansevière	Dracaenaceae	Leaf	12	**0.86**	35	**2.92**
36	***Sansevieria trifasciata*** **Prain.**	Ngwaka : Ndama, Gbua, Kuwa, Pua Libinza : Lilanga lankoi Nom vulgaire : Sansevière	Dracaenaceae	Leaf	13	**0.93**	36	**2.77**
37	***Scorodophloeus zenkeri*** Harms	Bofizi (bopizi) / Lomongo : Bofili / Lokonda : Bopili / Mpama : Mbopili	Caesalpiniaceae	Leaf, bark	12	**0.86**	31	**2.58**
38	***Smilax anceps*** *Willd.*	Likokoloko (Walokodjwa) / Kirega : Musulindi / Lomongo : Bokiki	Smilacaceae	Leaf	12	**0.86**	31	**2.58**
39	***Solanum melongena*** **L.**	Ngungutu (aubergine)	Solanaceae	Fruit	09	**0.64**	24	**2.67**
40	***Thomandersia hensii*** **De Wild. & T.Durrand**	Monkooka Ngwaka : Ngboka / Mokula : Mangbanda / Mbanza : Ngoka / Lomongo : Imele mpaka	Ancathaceae	Leaf, stem	12	**0.86**	31	**2.58**
41	***Zingiber officinalis***	Tangawisi	Zingiberaceae	Rhizome, leaf	12	**0.86**	26	**2.17**
		Species not yet identified						
42	*No Identified*	**Molu mahapa**		Leaf, bark of root	09	**0.57**	20	**2.22**
43	*No Identified*	**Libamba (fougère du palmier)**	Filicopsidaceae	Stem, leaflets	11	**0.78**	31	**2.82**
44	*No Identified*	**Wenye (wenyu)**		Leaf, bark	10	**0.71**	26	**2.60**
45	*No Identified*	**Eponze**		Leaf, bark, root	09	**0.64**	21	**2.33**
46	*No Identified*	**Bosoi (boholi)**		Leaf, stem bark	11	**0.78**	26	**2.36**

The data in **Table 1** shows that the ethnobotanical inventory has resulted in 41 identified plant species and a further 5 not yet determined. The yet undetermined species occupy positions 42 to 46. The remaining 41 species are divided into 28 families of which Zingiberaceae is represented with 5 species (*Aframomum citratus*, *Costus polycephalus*, *Costus afer*, *Costus lucanusianus,* and *Zingiber officinalis*). The Fabaceae family follows with 3 species (*Erythrophloeun suabanes*, *Mucuna pruriens,* and *Phaseolus sp.*).

The family Solanaceae is represented with 2 species (*Capsicum annuum* L. or *C. frutescens* and *Solanum melongeta*). The remaining families are generally represented with one species each. No species has a VU lower than 1.50. No species also has a VU of 1.50. This implies that all species have a high use value, i.e., they are over-exploited or on the verge of extinction. These species are really in a phase of progressive degradation of their natural environment given the galloping demographic pressure due essentially to the strong presence of non-natives on the one hand, and also to the degradation of habitats due to timber exploitation and the repetitive flooding of the town of Mbandaka.

DISCUSSION

In the entire study area, 1164 subjects were bitten by snakes, of which 585, or 50.26% were male and 579, or 49.74% were female.

Regarding the different traditional social groups thus identified, and based on the overall sample, among men, the HmaFe group is present with 105 cases or 9.02% followed by Hma with 87 cases or 7.47%. On the other hand, among women, the Fma group is in the lead with 97 cases, i.e., 8.33%, followed by Fvnp with 90 cases, i.e. 7.73%, and Fmae with 84 cases, i.e. 7.22%. For the category of children, the male sex slightly dominates in the number of bites (122 cases) compared to the female sex (119 cases).

When we grouped the subjects not in conflict with tradition on the one hand and the subjects apparently in conflict with tradition on the other, we find the following: the male subjects not in conflict represent a total of 186 bitten individuals and the subjects in conflict represent 399 bitten individuals. On the other hand, among the female subjects not in conflict with tradition, there are 189 bitten individuals and 390 conflicting subjects. The ratio of the number of individuals in conflict with each sex to the number of individuals not in conflict with each sex is slightly higher for men (2.14) than for women (2.06); the harmful action of snakes does not appear to be very significant in terms of sex. It is rather directed in terms of non-compliance with established traditional rules.

In terms of the overall frequencies recorded for men, the most important months in terms of bites are the months between January and July each year. This is the hot period. The peak is seen here in April, followed by a slowdown between May and July and a fall between August and December. The period of high incidences corresponds with the rise in rainfall.

According to gender, the %age of cured and healed is 89.23% for men and 89.98% for women. More men (6.15%) than women (4.66%) have suffered after-effects. Slightly more women (5.53%) died than men (4.62%). In all sexes combined, 89.52% of people were cured, while the number of deaths amounted to 59 people or 5.07%. In modern medicine in private health facilities, 57 cases of bites were recorded for the study period. 06 of these cases were declared cured (10.53%). Ten cases concerned subjects who had escaped with sequelae, i.e., 17.54%. There were 41 deaths, i.e., 71.93%, which is still a very heavy tragedy.

Of these two types of care, indigenous treatment inspires more confidence, and this explains the massive adherence, not only because traditional practitioners offer better care, but also because patients can begin to take the first steps, knowing how to exploit certain resources that they know about in the collective memory.

The results obtained from our surveys in the three sites, covering a total of seven villages, the majority of which are controlled by the Mongo tradition, show that the problem of snakebite is undoubtedly a public health problem, given the number of cases reported by traditional healers and the households that were victims of snakebite and envenomation during the surveys.

A comparison with the results obtained in the Bonginda grouping (Mokekola et al. (2022) shows that the situation remains dramatic in both cases. The state health structures do not offer confidence to snakebite patients. Ngbolua (2021) states that successful treatment of snakebites in rural areas requires the involvement of traditional health practitioners. This is also true in the present study.

Regarding the plant resources inventoried, the present study was able to inventory 46 species, 41 of which were fully determined and divided into 28 families, while Ngbolua (2021) counted 17 medicinal plants belonging to 16 botanical families that are used against snake bites in forest areas.

The species inventoried in the liquid space of the city of Mbandaka are essentially those of terrestrial and aquatic environments. This implies that the aquatic environment being poor, traditional practitioners in the study area, which is almost entirely occupied by swamps and river channels, would have difficulty in obtaining plant material. This would explain the very high ethnobotanical use values of these plants in such an environment. Also, the intensive use of these species, to cope with the numerous cases of ever-increasing bites, could contribute to the reinforcement of the degradation of the rare reserves still present, undoubtedly accelerating the extinction of some of them, already victims of the almost savage logging of the peri-urban forest of the Mbandaka City.

As for the most representative families, we can mention the Zingiberaceae families with 5 species (*Afromomum citratum*, *Costus polycephalus*, *Costus afer*, *Costus lucanusianus*, and *Zingiber officinalis*) whose biological action is supported by the spiritual action capable of cancelling the inflammations and other nuisances and invisible pursuits of which the bitten person is victim. Some other plants such as *Sansevieria liberica*, *Sansevieria trifasciata* (Synonym S. laurentii), *Ocimum gratissimum*, *Ocimum bassilicum*, *Eleusina indica,* and *Agerantum conyzoides*, which have highly exemplary values of use, are said to act in the same way. The Fabaceae family follows with 3 species (*Erythrophloeun suabanes*, *Mucuna pruriens,* and *Phaseolus sp.*). These three plants are said to have a definite therapeutic advantage in destroying snake-induced poison, but their use is more often associated with other plants or with some animal extracts, including the heads of the most poisonous snakes and scorpions.

CONCLUSION

The study aimed to elucidate the problem of snakebite by integrating the dimension of the socio-traditional groups most affected by snakebite around the liquid space of the city of Mbandaka in the province of Equateur in the DRC.

The results not only affirm that the pathology of snakebite and envenomation is a case of neglected pathologies in the province of Equateur, but also that traditional medicine is capable of treating the pathology given the percentage of cures achieved by traditional healers and that the current trend in the frequency of snakebites is not only the result of a lack of information but also the result of a lack of awareness of the problem, that the current trend in the frequency of bites recorded in the study area, although not too exaggerated, corroborates the traditional popular dogma of the area according to which the most bitten are to be counted among the individuals living in conflict with the totem or declared cursed by tradition.

While recognising the complexity of the subject, it is important to modernise the principles and methods of traditional medicine which are still archaic. This raises the issue of the positioning of traditional medicine in competition with modern medicine, which is both luxurious and much more discriminatory towards the Congolese rural citizen.

The abundant wealth traditionally used by traditional practitioners, we believe, opens the way to advanced research that could lead to the extraction of selective active principles to make oral serums and other effective and early medicines for the fight against venom. Also, among this wealth, it seems possible to work on understanding which of the plants have repellent effects

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