

Accidents occasioned by venomous animals in Southern cities of Minas Gerais: a retrospective study

Acidentes ocasionados por animais peçonhentos em municípios do sul de Minas Gerais: um estudo retrospectivo

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ABSTRACT

Background: Accidents caused by venomous animals have variable classifications and evolutions, which can lead to sequelae or death, and generating serious public health problems still neglected by authorities. Knowing these accidents and promoting public awareness about prevention can lead to favorable outcomes. **Materials and methods:** This retrospective study analyzed the main characteristics of these accidents, in the municipalities belonging to the microregion of the South of Minas Gerais (MG), between 2015 to 2019. Data were compiled through the interface of the Secretary of State of MG, on the Health Surveillance Portal. **Results:** With a high number of cases, from the total cases of accidents in the analyzed municipalities ($n = 6728$), the most frequent were those involving spiders ($n = 2085$, 31%), bees ($n = 1530$, 23%), scorpions ($n = 1166$, 17%), caterpillars ($n = 758$, 11%) and snakes ($n = 437$, 6%), with increased cases in the summer, and according to the county ($p < 0.05$). Most of the accidents reported were occupational, being men and the age group from 20 to 59 years, which concentrates the workforce, the most affected. Most medical visits took place at the first six hours, which resulted in a relatively low mortality rate and decreased risk of complications/sequelae, with such cases being mostly classified as mild/moderate ($p < 0.01$). **Conclusion:** It was alarming the number of accidents involving venomous animals in the south of MG. Furthermore, the insufficiency in the database arising from underreporting or missing information collected makes it difficult to identify the real magnitude of events involving venomous animals, in which the number of cases may be even greater.

RESUMO

Introdução: Acidentes com animais peçonhentos possuem classificações e evoluções clínicas variáveis, podendo causar sequelas ou levar a morte, e constituem um problema de saúde pública grave e negligenciado pelas autoridades. Conhecer estes acidentes e promover a conscientização da população sobre prevenção podem conduzir a desfechos favoráveis. **Materiais e métodos:** Este estudo retrospectivo analisou as principais características destes acidentes, nos municípios do Sul de Minas Gerais (MG), entre 2015 a 2019. Compilou-se os dados através da interface da Secretaria do Estado de MG, Portal de Vigilância em Saúde. **Resultados:** Com um elevado número de casos, dos casos totais de acidentes nos municípios analisados ($n = 6728$), os mais frequentes foram aqueles envolvendo aranhas ($n = 2085$, 31%), abelhas ($n = 1530$, 23%), escorpiões ($n = 1166$, 17%), lagartas ($n = 758$, 11%) e serpentes ($n = 437$, 6%), com um aumento de casos no verão e de acordo com o município ($p < 0,05$). A maioria dos acidentes notificados foram ocupacionais, sendo homens e faixa etária de 20 a 59 anos, que concentram a força de trabalho, os mais acometidos. A maioria dos atendimentos médicos aconteceram nas primeiras seis horas, o que resultou em um índice relativamente baixo de mortalidade e diminuiu o risco de complicações/sequelas, sendo tais casos em grande parte classificados como leve e moderado ($p < 0,01$). **Conclusão:** o número de acidentes envolvendo animais peçonhentos no Sul de MG mostrou-se alarmante. Ainda, constatamos que a insuficiência na base de dados advindos de subnotificações ou de informações omissas colhidas dificulta a identificação da real magnitude dos eventos envolvendo animais peçonhentos, em que o número de casos pode ser ainda maior.

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Introduction

The generic term “venomous animals” or “poisonous animals” encompasses those species, occurring in numerous phyla, that have venomous glands that communicate with hollow teeth, or stingers, or stingers, through which the venom actively passes. They inoculate a toxic product simply and actively, including in this class, for example, snakes, spiders, scorpions, centipedes, bees, wasps, hornets and stingrays.¹

Accidents caused by venomous animals are serious public health problems around the world and mainly affect the most socially vulnerable population residing in rural areas, with limited access to education and basic health services², being an emergency frequent clinical condition in several tropical countries, mainly in the countryside and rural areas of Brazil, such as the south of

Minas Gerais.³ Still, the wide distribution of these agents that can even reach urban areas, is associated with human mobility, urbanization and the growing curiosity to explore nature, as well as the predatory exploitation and urbanization of restricted environmental areas and the various damages to the environment, make these accidents are more and more frequent in modern life.⁴

Currently, four systems in Brazil include the registration of accidents by venomous animals: Notifiable Diseases Information System (SINAN/Ministry of Health), National Toxic-Pharmacological Information System (SINITOX/Oswaldo Cruz Foundation/Ministry of Health), Hospital Information System of the Unified Health System (SIHSUS/Ministry of Health), and the Mortality Information System (SIM/Ministry of Health).⁵ Data from SINITOX show that venomous animals are the second largest agent of human intoxication in Brazil, being

surpassed only by medication in indiscriminate/inappropriate conditions.⁶

From this context, which involves an extremely relevant issue in public and collective health, but is still neglected by public health authorities, the main objective of this study was to collect and analyze epidemiological data identifying the characteristics of accidents involving venomous animals in municipalities in the region of South of Minas Gerais, including the profile of those affected, distribution, seasonality and severity of events related to accidents.

Methods

Study design

This is a retrospective, descriptive, secondary-based study that analyzed the available database on accidents with venomous animals in several municipalities in the southern region of Minas Gerais. Data from accidents with venomous animals were analyzed in the following municipalities: Arceburgo, Alfenas, Alterosa, Areado, Bandeira do Sul, Botelhos, Cape Verde, Campestre, Campo do Meio, Campos Gerais, Carmo do Rio Claro, Carvalhopilis, Conceição da Aparecida, Divisa Nova, Fama, Guaranésia, Guaxupé, Juruaia, Machado, Monte Belo, Muzambinho, Nova Resende, Paraguaçu, Poço Fundo, São Pedro da União and Serrania. The analyzed period comprised notifications from 2015 to 2019. As inclusion criteria, all records in the aforementioned period were considered, without exclusion restrictions, with data coming from the base and considered incomplete and reported in the present study as "white" or "ignored".

Data collection

Data on accidents with venomous animals were related to the year of the accident, month, several notifications by municipalities, animals involved, predominant types of snakes and spiders, occupational accidents, sex, age, ethnicity, pregnant woman, time for care, classification end and evolution of the injured. Such data come from the website of the Secretary of the State of Minas Gerais (SESMG), from the Health Surveillance Portal; sources: SINAN/CPDE/DIE/SVE/SubVS/SESMG, 2019.

Statistical analysis

Data are presented by basic measures (absolute numbers and percentages) and, to statistically analyze the existence of independence between the aforementioned variables, the chi-square test was used, at a nominal level of 5% of significance.⁷ Statistical analysis was performed using the R[®] software.⁸

Results

As seen in the present study, Table 1, the southern region of Minas Gerais has an alarming number of accidents involving venomous animals, with 6728 notifications between 2015 and 2019. There was a difference between the number of accidents by municipalities and the animals involved, ($p < 0.01$), with Guaxupé, Alfenas and Muzambinho standing out for a large number of accidents and, conversely, Areado, Campo do Meio and Fama had few reported cases. Table 1 shows that 30.98% of the accidents were caused by spiders, 22.74% by bees, 17.33% by scorpions, 11.26% by caterpillars and 6.49% by snakes.

Table 1. Number of accidents by municipalities in the south of Minas Gerais and the respective animals involved, 2015-2019

	Bees	Spiders	Scorpions	Caterpillars	Snakes	Other	White	n (%)
Guaxupé	210	161	339	69	11	183	14	987 (14,67)
Alfenas	214	118	214	33	185	67	-	831 (12,35)
Muzambinho	333	295	20	106	33	1	1	789 (11,72)
Campestre	73	234	25	121	12	37	-	502 (7,46%)
Machado	150	200	89	23	28	6	2	498 (7,40%)
Botelhos	76	166	1	72	9	133	30	487 (7,23%)
Paraguaçu	67	64	169	97	6	36	7	446 (6,62%)
Poço Fundo	98	203	107	-	11	3	-	422 (6,27%)
Monte Belo	13	112	55	34	12	25	2	253 (3,76%)
Conceição da Aparecida	64	98	-	51	12	3	1	229 (3,40%)
Bandeira do Sul	72	65	2	11	6	50	2	208 (3,09%)
Juruaia	27	108	2	34	14	12	6	203 (3,01%)
São Pedro da União	37	73	-	56	16	6	-	188 (2,79%)
Guaranésia	24	37	50	2	12	26	3	154 (2,28%)
Serrania	28	31	2	33	2	45	1	142 (2,11%)
Arceburgo	25	17	33	1	3	7	-	86 (1,27%)
Cabo Verde	4	30	5	3	23	19	-	84 (1,24%)
Divisa Nova	6	19	21	6	5	21	-	78 (1,15%)
Carmo do Rio Claro	7	21	11	1	10	-	-	50 (0,74%)
Nova Resende	-	18	-	1	12	1	-	32 (0,47%)
Campos Gerais	-	4	16	-	6	-	-	26 (0,38%)
Alterosa	-	7	2	2	4	1	-	16 (0,23%)
Carvalhópolis	2	1	-	2	-	1	-	6 (0,08%)
Campo do Meio	-	1	-	-	3	-	-	4 (0,05%)
Fama	-	1	3	-	-	-	-	4 (0,05%)
Areado	-	1	-	-	2	-	-	3 (0,04%)
Total	1530	2085	1166	758	437	683	69	6728 (100%)

Regarding the number of accidents per period, there was a significant difference between the months of 2015 and 2019 ($p < 0.01$). The months of January, February, March and May had a higher frequency of accidents.

Between 2015 and 2018, there was a progressive increase in the number of accidents with venomous animals, however in 2019, there was a decrease of 1% when compared to 2018 (Table 2).

Table 2. Number of accidents that occurred in the 26 municipalities analyzed per month and year

	2015	2016	2017	2018	2019	n (%)
January	79	118	90	169	152	608 (9,03%)
February	85	130	174	188	140	717 (10,65%)
March	86	130	165	222	201	804 (11,95%)
April	77	82	114	160	143	576 (8,56%)
May	86	102	102	130	213	633 (9,40%)
June	76	104	123	132	131	566 (8,41%)
July	122	96	75	101	95	489 (7,26%)
August	67	66	121	98	99	451 (6,70%)
September	75	57	94	83	118	427 (6,34%)
October	78	75	99	130	121	503 (7,47%)
November	79	70	110	96	123	478 (7,10%)
December	93	85	140	116	41	475 (7,06%)
n (%)	1003 (15%)	1115 (17%)	1407 (21%)	1625 (24%)	1577 (23%)	6728 (100%)

The relationship between animal type and sex was statistically significant ($p < 0.01$). There was a tendency towards equality between the types of animals involved in both sexes, except for snakes and scorpions. Higher frequencies of both involved in accidents with men were observed (Table 3). As also observed in this study (Table 3), 0.07% of accidents related to spiders corresponded to

Latrodectism, 0.83% Loxoscelism, 1.59% Phoneutrism, and other spiders were responsible for 24.07% and 73.42% of the data was ignored/blanked. Table 3 shows that 0.2% of the cases involving snakes corresponded to Elapidic, 0.2% Laquetic, 0.47% non-venomous snakes, 2.39% Crotalus, 3.06% Bothropic and 94% of the data were ignored or white.

Table 3. Distribution of accidents involving venomous agents in the south of Minas Gerais, 2015-2019, n = 6728

TYPES OF AGENTS ACCORDING TO GENDER (%)						
	Bees	Spiders	Scorpions	Caterpillars	Snakes	Other/White
Male	23	31	15	11	8	12
Female	23	30	22	11	3	11
ACCIDENTS WITH SNAKES (%)						
	Elapidic	Laquetic	Non-venomous	Crotalus	Bothropic	White
	0,03	0,03	0,5	2	3	94
ACCIDENTS WITH SPIDERS (%)						
	Latrodectism	Loxoscelism	Phoneutrism	Other spiders	White	
	0,07	0,8	2	24	73	

Regarding the ethnicity of those affected, Caucasians were the most affected, as well as the age group between 20-59 years (Table 4). It is observed that occupational accidents were more frequent, with males being the most affected, as shown in Table 4. Despite the

low frequency of cases, the pregnant condition presented higher lethality (1.33%) compared to the general lethality in females (0.39%), with a higher number of accidents being observed in the third trimester of pregnancy.

Table 4. Profile of victims of accidents involving venomous agents in the South of Minas Gerais, 2015-2019, n = 6728

Variable		n (%)
Gender	Male	4445 (66,06%)
	Female	2283 (33,93%)
Ethnicity	Leucoderma	5027 (74,71%)
	Melanoderma/Pheoderma	1633 (24,26%)
	Xanthoderma	29 (0,43%)
	Indigenous	10 (0,14%)
	Ignored	29 (0,43%)
Pregnant women (Quarter)	1 ^o quarter	11 (0,16%)
	2 ^o quarter	10 (0,14%)
	3 ^o quarter	15 (0,22%)
	Ignored	3 (0,04%)
Age range (years)	Less than 1	60 (0,89%)
	1 to 19	1356 (20,15%)
	20 to 59	4257 (63,27%)
	Above 60	1055 (15,68%)
Occupational accidents	Yes	4544 (67,53%)
	No	2098 (31,18%)
	Ignored	86 (1,29%)
Time for medical care (hours)	0-1	4092 (60,82%)
	1-3	1441 (21,42%)
	3-6	415 (6,17%)
	6-12	148 (2,2%)
	12-24	181 (2,69%)
	Above 24	328 (4,87%)
	White	123 (1,83%)

Table 5 shows that 88.4% of the consultations occurred within a period of up to 6 hours, with 98.55% of cases classified as mild and moderate, while only 0.78% were considered severe. When relating sex and accident classification, it was observed that the two variables act in a dependent way ($p < 0.01$). Table 5 shows that mild classification was slightly more common compared to males. This higher frequency was not maintained for the moderate and severe classifications, which were more frequent in men. As for the clinical evolution, Table 5, there was a difference between the sexes ($p < 0.01$). Men evolved with a frequency of 17 percentage points more when compared to the clinical evolution of women.

Table 5. Classification of events involving venomous agents in the south of Minas Gerais in victims according to sex, 2015-2019, n = 6728

Variable		Male	Female
Accident classification	Light	92%	94%
	Moderate	7%	5%
	Serious	1%	0,3%
Clinical evolution	Yes	37%	20%
	No	62%	79%
	White	1%	1%

Discussion

The present study analyzed accidents involving venomous animals in municipalities in the southern region of Minas Gerais, Brazil. There was a considerable frequency of these accidents in the analyzed municipalities, between 2015 and 2019, with a consequent high incidence of associated health problems. The difference between the number of reported cases in the municipalities, observed here, may reflect several aspects, including factors such as ecological diversity, socioeconomic activities and cultural differences, such as the perception of the venomous animal by the population. The state of Minas Gerais is located in the Southeast Region of Brazil, being the fourth state with the largest territorial area and the second in population, with approximately 21 million inhabitants. With a predominantly agricultural economy, with an emphasis on coffee plantations, there is a need for policies aimed at preventing accidents involving the agricultural sector. Although accidents involving venomous animals have a social and economic impact in developing countries, there is still not a priority for the design of public health programs, since, historically, accidents involving venomous animals are one of the most neglected health problems.⁹ In Brazil, there is a heterogeneity of habitats that favors a diversity of venomous species with relevance to public health, also varying between cities.¹⁰

Data from reports of accidents by venomous animals have increased mainly in rural areas, and the total rural populations of the analyzed municipalities vary considerably. One of the main causes of these accidents may be related to anthropic changes in the environment.¹⁴ Thus, the population of rural workers is often affected, mainly due to proximity to natural environments, precarious working conditions, difficulties in accessing health services and lack of knowledge.¹⁵ Therefore, the epidemiological characteristics, environmental factors, anthropic actions and the social condition, are directly reflected in the geographic distribution of accidents with venomous animals, given that, the analyzed municipalities presented a huge discrepancy in the numbers of such accidents.

As for seasonality, there was an increase in cases in the summer, justified by the higher humidity, heat and the breeding season. Regarding the main venomous animals involved, it is highlighted that spiders and snakes are more active in the summer and autumn seasons, while scorpions are more active in the spring season. As for the activity of spiders, the seasonality of accidents follows the patterns known in the literature and is related to the greater activity (locomotion mainly) of spiders in the warmer months and mating months.¹³

In this study, the most frequent venomous animals involved in accidents were observed. The need for knowledge of the agent, or at least notion, is highlighted so that the most appropriate medical care is provided. In Brazil, most accidents caused by scorpions are caused by those belonging to the genus *Tityuse*, among spiders, the most important genera are *Loxosceles*, *Phoneutria* and *Latrodectus*.¹¹ These data are in line with those seen in the present study. Brazil has several snake families. Among these, only two covers the snakes considered venomous: the family *Viperidae*, highlighting the subfamily *Crotalinae*, to which the genera *Crotalus* (Cascavel), *Bothrops* (Jararaca) and *Lachesis* (Surucucu) belong; and the *Elapidae* family, which encompasses the genus *Micrurus*, whose species are popularly known as true corals.¹² Recurrently, cases involving *Crotalics* and *Brotropics* were the most reported. Of note, the neglect observed in the primary database is alarming, in which 94% of the data is "ignored" or is "blank".

As for the profile of people who have suffered accidents with venomous animals, in general, men, whites and aged between 20 and 59 years, the group that concentrates the workforce, were the most affected. Accidents with snakes were more common in males and, with scorpions, in females. For the other agents, there was a balance between the two sexes. It appears that men are more susceptible to accidents involving venomous animals, because they are usually in crops and forest environments, due to professions, correlated with the agricultural areas of southern Minas Gerais. Regarding the age group of victims, the age group in which the workforce is concentrated and which is

equivalent to the economically active population is the most affected, usual individuals between 20 and 59 years old.

Currently, accidents involving venomous animals continue to constitute a serious public health problem, both due to the number of registered cases and their severity, which can lead to death or sequelae capable of generating temporary or permanent incapacity for work and usual activities. In addition, these sequelae generate local complications that may be related to the adoption of non-indicated first aid measures, such as the use of a tourniquet and the delay in seeking medical care.¹⁷ Regarding the response profile to the injured and the dynamics of seeking care, this study demonstrates that most of the visits took place in the interval of up to 6 hours, therefore, the victims sought care in the first hours of the event. The close relationship between the time of care and the final classification of the injured is highlighted, since most cases (98.55%) were mild and moderate, while only a minority of cases (0.78%) were considered conditions, promptness and treatment capacity are factors that prevent serious sequelae and save lives. This highlights the relationship between the time of accident occurrence and medical care, as the longer the time for care, the greater the risk of complications, sequelae and mortality. Furthermore, the severity caused by the venom can vary greatly due to the species of the venomous animal, the victim's age, the amount of inoculated venom and the bite site.¹⁸ According to the Ministry of Health, the treatment is more efficient the sooner the patient is seen and the antivenom is administered, which should be directed to the identified agent.¹⁹

In this sense, related to morbidity and mortality, for example, in addition to the increased risk of death of victims of snakebites, when they are pregnant, there is also the possibility of complications and obstetric sequelae and risk to the fetus (such as vaginal bleeding, contraction uterus, threatened abortion, decreased fetal movements and fetal death).¹⁶ As observed, for pregnant women, the highest rate of incidents was verified in the third trimester of pregnancy, a critical period for spontaneous abortions and other complications of premature birth.

As considerations of the findings and limitations, Brazil being the holder of the largest flora and fauna on the planet, there is a need for studies to know the biotechnological potential of venomous animals, as well as the discovery of new therapies for such medical emergencies involving them, because in this way new drugs and treatments will be developed. To maintain the ecological balance, the need to make the population aware of the intimate relationship between man and nature was emphasized, avoiding accidents and reinforcing emergency measures concerning them. As for the accident information system, the implementation of measures to reduce or eliminate the occurrences of

incomplete data must be provided, aiming at improvements in the actions to be developed, but it is noteworthy that part of the lost information may occur due to the emergency nature of the accidents that lead to the ignorance of some factors, such as the correct identification of the causative agent (genus and species) and follow-up of the affected person.

Conclusion

Spiders, bees, scorpions, caterpillars and snakes were the main causes of accidents in the municipalities of southern Minas Gerais. There was considerable variation in the number of accidents in such municipalities, and an increase in cases was observed in the summer. Most of the accidents reported in the analyzed period were occupational, and men and in the age group from 20 to 59 years were the most affected. Most medical visits took place within the first six hours, which resulted in a relatively very low mortality rate and reduced the risk of complications and sequelae, with such cases largely classified as mild and moderate. However, the large number of blank and skipped data makes these notifications unreliable. It was noted that victims of such accidents were often unable to identify the causative agent, thus requiring a multidisciplinary team to conduct specific treatment.

Conflict of interests

The authors declare that there is no potential conflict of interest.

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