Epidemiological analysis of accidents by scorpions in a municipality in the *Triângulo Mineiro*

Ana Laíza Ferreira Mota[1], Anna Myrian Vieira Arruda[1], Guilherme Cerva de Melo[1], Stefan Vilges de Oliveira[2]

ABSTRACT

Introduction: Minas Gerais is the Brazilian state with the highest rate of scorpionism, 223,033 cases were recorded between 2010-2017, so reflections on how to reduce this public health problem are necessary. **Objective:** to describe the epidemiological profile of accidents with scorpions that occurred in the municipality of Patos de Minas (MG), from 2013 to 2017, and to develop an intervention project based on it. **Methods:** First, the number of accidents by venomous animals in Patos de Minas (MG) was analyzed using the variables included in the SINAN notification and investigation form, available on DATASUS. Additionally, two databases, CAFE and Pubmed, were used for the theoretical framework, with the following descriptors: "*escorpião*", "*Minas Gerais*", "*envenenamento*", "*prevenção*", and their respective translations into English: "scorpion", "Minas Gerais", "envenomation" and "prevention". **Results:** Scorpion sting accidents were the most recorded among venomous animals, and were increased annually during the study period, reaching, in 2017, the number of 274 reported cases. In addition, the frequency of accidents was recorded in greater numbers in males (51.18%) and the most affected age group was between 20 and 39 years of age (32.64%). It is also observed that most of the victims were classified as mild cases and treated in the first hour of the sting (97.92%), with no deaths in the period. The results found are in agreement with the references used, being more common, in studies, the registration of mild cases, in male adults. For the basis of the intervention proposal, five articles were used, and based on them, preventive, corrective environmental and educational actions are proposed. **Conclusion:** The study allowed to identify the target audience of the intervention proposals and when they should be intensified, to try to contain, thus, the constant increase in cases of scorpionism in the analyzed municipality.

Keywords: Scorpion sting, Epidemiology, Accident prevention, Epidemiological surveillance.

1. Universidade Federal de Uberlândia, Uberlândia, (MG), Brazil
2. Universidade Federal de Uberlândia. Faculdade de Medicina. Departamento de Saúde Coletiva, Uberlândia, (MG), Brazil

https://doi.org/10.11606/issn.2176-7262.rmrp.2022.195191

INTRODUCTION

The medically important scorpions in Brazil belong to the genus *Tityus* and can be found in dry areas, humid biotas, coastal areas and urban regions. The nocturnal habit is recorded for most species. Inside the home, these venomous arthropods can hide in closets, shoes or under clothes on the floor, thus increasing the risk of accidents[1-2].

In scorpion accidents clinically classified as mild, serotherapy is not necessary, and only symptomatic treatment is recommended. However, children up to 9 years of age (mainly those under 7 years old), are at greater risk of systemic complications and death, especially in accidents caused by *T. serrulatus*. Remarkably, the clinical picture of envenomation is dynamic and can progress to greater severity in a few hours[1-3].

Diagnosis is eminently clinical and epidemiological, and routine laboratory tests are not required to confirm the type of circulating venom. Nonetheless, some complementary exams are useful to aid in diagnosis and follow-up of patients with systemic manifestations, such as: electrocardiogram, chest X-ray and biochemical parameters[1-2].

According to the Ministry of Health, there are some Brazilian regions with high rates of scorpion stings, highlighting the Northeast with 447,971 occurrences, followed by the Southeast with 397,187. In Brazil, Minas Gerais is the first in the ranking of the states, with 223,033 cases, which increased from 1,189 cases in 2000 to 27,955 in 2017, with a significant increase in incidence from 67 to 1324 per 100,000 inhabitants[4-6].

Thus, this study aimed to describe the epidemiological profile of accidents caused by scorpions that occurred in the municipality of Patos de Minas (MG), from 2013 to 2017, considering the database of accidents by venomous animals reported in the Notifiable Diseases Information System (SINAN), and develop an intervention project based on it.

METHODS

This is an epidemiological study aimed to investigate data from scorpion sting victims and establish effective forms of intervention in primary (preventive) care. This research also included a literature review, since it used bibliographic and documentary sources, and the analysis of accidents with venomous animals to develop an intervention project in Patos de Minas. The municipality has a population of 153,585 inhabitants distributed in a total area of 3,190 km^2, with a population density of 48.15 inhabitants per kilometer and located 457 kilometers from the capital, Belo Horizonte. Patos de Minas is located in the intermediate region of Triângulo Mineiro and Alto Paranaíba, being a regional economic center, leading the micro-region of Alto Paranaíba. The city has great significance in national agribusiness and grain production, plays a key role in swine genetics and is the first municipality in the production and quality of milk in Minas Gerais, being the second in the country.

The literature review (Figure 1) adopted as a search criterion the consultation of electronic databases (CAFE and Pubmed) with the following descriptors: "*escorpião*", "*Minas Gerais*", "*envenenamento*", "*prevenção*", and their respective translations into English: "scorpion", "Minas Gerais", "envenomation", and "prevention". The inclusion criteria were national articles focusing on primary health care, risk factors and preventive actions. The exclusion criteria were articles that addressed the treatment and care of cases of scorpionism.

Furthermore, the number of accidents by venomous animals in Patos de Minas was assessed using the variables that include the SINAN notification and investigation form, available on DATASUS (https://datasus.saude.gov.br/informacoes-de-saude-tabnet/)[7]. The accidents caused by scorpions were selected and, then, the following characteristics: age group (categorized); sex (male or female); final classification (mild, moderate, severe; ignored/blank), time elapsed between the bite and the medical care in hours (0 to 1h; 1 to 3h; 3 to 6h; 6 to 12h; 12 to 24h; more than 24h; ignored).

The variables and the results in absolute and relative frequencies were constructed using descriptive statistics. Additionally, the incidence coefficient of accidents caused by scorpions in Patos de Minas was calculated through the formula: number of accidents in the municipality divided by the population and multiplied by 100,000 inhabitants, from 2013 to 2017, according to the population estimates provided by the Brazilian Institute of Geography and Statistics (IBGE), on the DATASUS

website. The Excel software and the DATASUS Tabnet platform were used to develop the analyses.

The research followed the ethical guidelines, as it was carried out from a secondary database, in which it is not possible to access information that allows the identification of patients. Therefore, submission to the Human Research Ethics Committee was not required, but the recommendations of the National Health Council Resolution No. 510, of April 7, 2016[8] were followed.

RESULTS

Among the reported cases of accidents by venomous animals from 2013 to 2017 in Patos de Minas, scorpionism had the highest number recorded, with 1,011 notifications (Figure 2), in which there is a progressive increase during the study period, reaching 274 cases in 2017. The average incidence of scorpionism was 135.2 per 100,000 inhabitants (Figure 3).

The months of September, October, November and December revealed the highest number of accidents, thus exhibiting that they occur in the hot and humid months (Figure 4). In turn, January and February had the lowest number of notifications.

In Table 1, the frequency of accidents was recorded in greater numbers in males (51.18%), while the most affected age group was 20-39 years old (32.64%), followed by the 40-59 age group (30.37%). The findings also demonstrated that most of the victims were treated in the first hour of the bite, with 97.92% classified as mild cases. No deaths were recorded in the research period.

Table 2 depicts a summary presentation of the intervention projects for scorpionism found in the references selected by the inclusion and exclusion criteria.

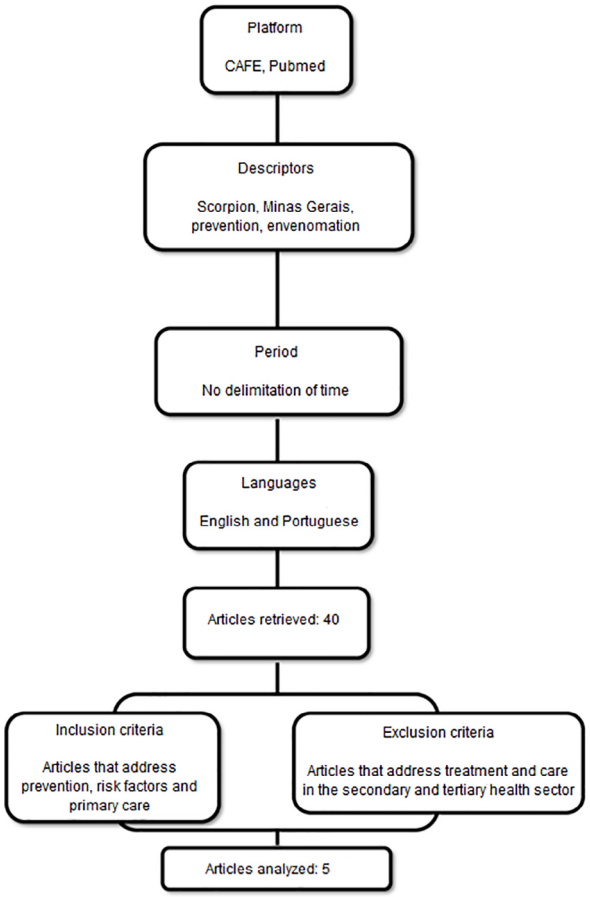

Figure 1: Database and the flow of the selection process, eligibility and inclusion of articles used in the design of the intervention project.
Source: The authors.

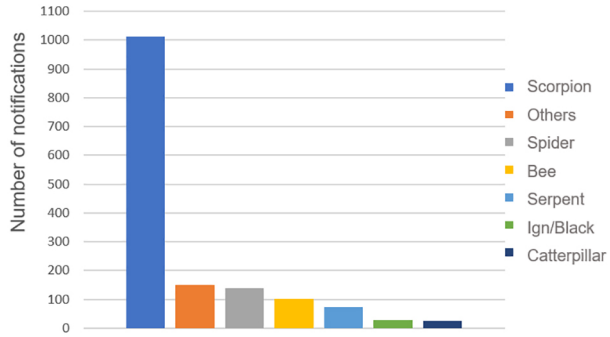

Figure 2: Reported cases of accidents by venomous animals in Patos de Minas (2013-2017).
Source: Data extracted from the Ministry of Health/SVS - Notifiable Diseases Information System - Sinan Net.

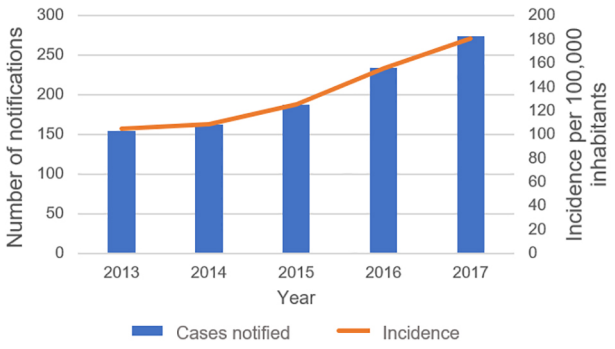

Figure 3: Number of accidents caused by scorpions and incidence in Patos de Minas (2013-2017).
Source: Data extracted from the Ministry of Health/SVS - Notifiable Diseases Information System - Sinan Net.

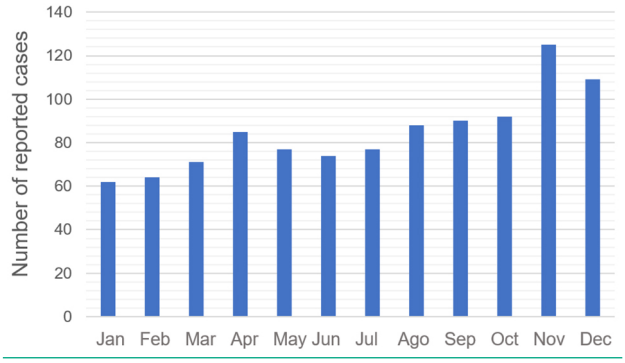

Figure 4: Reported cases of scorpionism according to the month of the accident in Patos de Minas (2013-2017).
Source: Data extracted from the Ministry of Health/SVS - Notifiable Diseases Information System - Sinan Net.

DISCUSSION

The notification to the Ministry of Health of an accident involving a venomous animal is mandatory in order to recognize the epidemiological profile and, consequently, surveillance actions, health care and the availability of specific serum considering the aggressor animal[14]. The results indicated a growing increase in cases of scorpionism in Minas Gerais, recording 27,955 cases in 2017. Notably, in Patos de Minas, the cases also increased each year, totaling 274 in the same period.

In a previous study that evaluated scorpion accidents in the east of Minas Gerais, from 2007 to 2016, the authors corroborate the period of stings from October to December[10]. Moreover, an analysis of accidents caused by venomous animals in Brazil, reported from 2010 to 2014 by SINAN, indicated in the 2014 data that all types of accidents, including those caused by scorpionism, occurred more frequently among the months of October to April[6]. In Patos de Minas, the cases of scorpionism were higher from August to December, reaching a peak in November, and this frequency also prevails with respect to the regional level. Indeed, these months are hot and humid and favor the reproduction of scorpions[13-15].

In our study, most victims (74.35%) were treated within the first hour of the accident. This agility can be explained by the fact that the municipality has predominantly urban households and by the ease of seeking medical care. Prior research on scorpionism in the pediatric age group,

Table 1.

Characterization of accidents according to age group, sex, time between the bite and the medical care and final classification in Patos de Minas, 2013-2017.

Variable	N	%
Age group		
<1 year	2	0.19
01-04	27	2.66
05-09	32	3.15
10-14	37	3.64
15-19	103	10.15
20-39	331	32.64
40-59	308	30.37
60-64	55	5.04
65-69	40	3.94
70-79	60	5.91
80 e +	19	1.87
Sex		
Male	519	51.18
Female	495	48.81
Time between the bite and the medical care		
Ignored/Blank	57	5.62
0 a 1 hour	754	74.35
1 a 3 hours	116	11.43
3 a 6 hours	36	3.55
6 a 12 hours	20	1.97
12 a 24 hours	19	1.87
24 e + hours	12	1.18
Final classification		
Ignored/Blank	2	0.19
Mild	993	97.92
Moderate	16	1.57
Severe	3	0.29
Total	**1014**	**100**

Source: Data extracted from the Ministry of Health/SVS - Notifiable Diseases Information System - Sinan Net.

Table 2.

Intervention projects cited in the articles selected by the systematic review.

Intervention project	Necessary resources	Expected results	References
Control measures (capture, mapping and educational campaigns) by the Zoonosis Control Department	Financial and human resources for the cost of teaching material on Health Education and urban hygiene	Reduction in the number of accidents with scorpions	SOARES; AZEVEDO; DE MARIA, 2002[9]
Control, capture (active search) and environmental management actions	Partnerships between bodies associated with urban cleaning, sanitation, public works and education	Reduction in the number of accidents with scorpions	MATOS et al., 2021[10]
In an integrated manner, preventive measures, environmental corrective measures and educational measures, applied continuously year after year	City Hall actions, including garbage collection, cleaning of vacant lots and chemical control; Partnerships with public and private schools	Scorpionism control, providing acceptable levels of infestation from an epidemiological point of view	CRUZ et al., 1995[11]
Use of protective personal equipment by construction and rural workers, in addition to environmental management	Financial and human resources for the cost of teaching material on Health Education and urban hygiene	Reduction in the number of accidents with scorpions	TORREZ et al., 2016[12]
Educational measures (distribution of leaflets, cleaning efforts), use of chemical control (in high-risk areas) and use of natural predators	Partnerships between bodies associated with urban cleaning, sanitation, public works and education	Scorpion control	COSTA et al., 2011[13]

conducted in the state of Minas Gerais, showed that 86.61% of the children received medical care between 0 and 3 hours, hence explaining the large percentage of 95.7% of patients cured and only 0.51% of deaths[6].

Children are part of the group most vulnerable to the worst prognosis, due to the relationship between the amount of venom inoculated with the body surface and lower immunological capacity: age is associated with higher serum levels of venom in the plasma, greater absorption by the organism, rapid and intense clinical effects[16]. Therefore, considering that adults were the most affected age group in Patos de Minas, the final classification consisted of a greater number of mild cases, owing to the smaller proportion of the vulnerable group affected.

Importantly, the intervention projects must be implemented in cities with a high rate of scorpionism, in an integrated way, preventive measures, corrective environmental strategies and educational actions, applied continuously year after year, including: cleaning of backyards, regular garbage collection, cleaning of vacant lots, reduction of local deforestation, and use of protective personal equipment. Furthermore, the experience of Aparecida[11] showed that it is possible, in the municipalities where the problem occurs, to integrate campaigns to combat scorpionism with those to control dengue, since the epidemiological situations of these two endemics overlap in various opportunities and can use the same team for both functions, thereby facilitating the execution of actions.

CONCLUSION

This study reported that in the five-year period, from 2013 to 2017, the epidemiological profile of scorpion cases in Patos de Minas was associated

with the age group 20-39 years, with emphasis on males. Of these registered cases, more than half of the victims were treated within the first hour of the bite and, then, 97.92% of these were classified as mild cases, with no deaths. This investigation allowed to identify the target audience of the intervention proposals already presented, especially with regard to educational and preventive strategies. Another valuable factor is knowing the period in which these practices should be intensified, that is, in the hot and humid months, given the highest number of accidents, in order to try to contain the constant increase in cases of scorpionism in this municipality.

REFERENCES

1. Ministério da Saúde (BR), Secretaria de Vigilância em Saúde. Coordenação-Geral de Desenvolvimento da Epidemiologia em Serviços. Guia de Vigilância em Saúde. 5. ed. Brasília (DF): Ministério da Saúde; 2021.
2. Ministério da Saúde (BR), Secretaria Vigilância em Saúde. Departamento de Vigilância Epidemiológica. Manual de Controle de Escorpiões. Brasília (DF): Ministério da Saúde; 2009.
3. Cupo P. Clinical update on scorpion envenoming. Rev da Soc Bras de Med Trop 2015, 48(6):642-649.
4. Ministério da Saúde (BR). Casos de acidentes por escorpiões. Brasil, Grandes Regiões e Unidades Federadas, 2000 a 2018. Brasília (DF): Ministério da Saúde; 2020a.
5. Ministério da Saúde (BR). Óbitos por escorpiões. Brasil, Grandes Regiões e Unidades Federadas, 2000 a 2018. Brasília (DF): Ministério da Saúde; 2020b.
6. Lima CAD, Alves CCH, Mendonça KS, Pires PLS, Medeiros NAS, Junior ERA et al. Epidemiologia do escorpionismo na faixa etária pediátrica no estado de Minas Gerais. Rev Elet Acervo Saúde 2021 Fev;13(2).
7. Ministério da Saúde (BR). Banco de dados do Sistema Único de Saúde (DATASUS) [acesso em 05 abr 2022]. Disponível em: http://www.datasus.gov.br.
8. Ministério da Saúde (BR). Conselho Nacional de Saúde. Resolução nº 510, de 7 de abril de 2016. Diário Oficial da União, 2016; 98: 44.
9. Soares MRM, Azevedo CS; Maria MD. Scorpionism in Belo Horizonte, MG: a retrospective study. Rev da Soc Bras de Med Trop 2002, 35:359-363.
10. Matos IM, Macedo LR, Ramiro LC, Alves LRM, Silva JGBPCP. Scorpionism in east Minas Gerais: clinical and epidemiological aspects. Rev Elet Acervo Saúde 2021; 13.
11. Cruz EFS, Yassuda CRW, Jim J, Barraviera B. Programa de controle de surto de escorpião Tityus serrulatus, Lutz e Mello 1922, no município de Aparecida, SP (Scorpiones, Buthidae). Rev da Soc Bras de Med Trop 1995; 28(2):123-128.
12. Torrez PPQ, Bertolozzi MR, França FOS. Vulnerabilities and clinical manifestations in scorpion envenomations in Santarém, Pará, Brazil: a qualitative study. Rev da Esc de Enf da USP 2016; 54.
13. Costa BC. Fatores de risco para acidentes com escorpiões: uma revisão de literatura. Governador Valadares. Monografia (Especialização em Atenção Básica em Saúde da Família) - Faculdade de Medicina da Universidade Federal de Minas Gerais; 2011.
14. Fontenele GC, Nobre MP, Prado RMS, Santos SLF, Torres KB. Análise de intoxicações em crianças atendidas no centro de assistência toxicológica do estado do Ceará. Bol Inf Geum 2015; 6:33-42.
15. Souza LM. Estudo Retrospectivo do Escorpionismo no Estado de Goiás (2003 - 2012). Goiânia. Dissertação (Programa de Pós-Graduação STRICTO SENSU em Ciências Ambientais e Saúde) - Pontifícia Universidade Católica de Goiás; 2016.
16. Carmo ÉA, Nery AA, Pereira R, Rios MA, Casotti CA. Factors Associated With The Severity Of Scorpion Poisoning. Texto e Contexto 2019;28.

Acknowledgement
We thank the team from the Department of Collective Health of the Faculty of Medicine of the Federal University of Uberlândia who encouraged this research, providing the resources for this study to be developed.

Authorship
All authors meet all authorship criteria.

Funding source
We declare that the study did not receive any funding..

Conflicts of interest
The authors declare no conflict of interest.

Corresponding Author:
Stefan Vilges de Oliveira
stefan@ufu.br

Editor:
Ada Clarice Gastaldi

Received: feb 22, 2022
Approved: jun 14, 2022
