






Venomous animals in Pernambuco: children at risk


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Abstract

Objectives: to analyze the epidemiological and clinical aspects of accidents caused by venomous animals in children under 15 years old.

Methods: a cross-sectional study with an analytical component using secondary data from Centro de Informação e Assistência Toxicológica de Pernambuco (CIATox-PE), (Poison Center in Pernambuco)), in 2017 to 2019. Notifications of accidents caused were included in the studied age group and evaluated the characteristics of poisoning (animal classification, exposure zone, place and time of the occurrence and specific use of serum therapy), and of the patient (sociodemographic variables, clinical condition and evolution). The analysis performed in STATA® 13.1 presents frequency distribution tables and Pearson's chi-square for comparison.

Results: of the 2678 notifications, 82,8% were scorpionism and 10, 8% snakebite. The age group of 1 to 9 years old (70.5%) and being male (54.1%) were predominant. Most of the cases occurred in urban area (80.9%), in Recife (67.3%), inside the victim's residence (83.9%) and at night (47.3%). The majority (87.1%) were classified as 'mild severity', 10% received antivenom therapy and one died (by scorpionism). Two cases of snakebite in the workplace were registered.

Conclusion: there was a high frequency of accidents caused in the urban area, which may be related to the lack of urban planning and sanitary education. The accidents caused among children in the household environment and the suspicion of child labor in the age group of 10 to 14 years old were also highlighted which favors the development and habits of the venomous animal.

Key words Envenoming, Animals venomous, Pediatrics, Epidemiology, Snake bites, Scorpion stings



Introduction

The second leading cause of poisoning in the pediatric age group is the accident caused by venomous animal.¹ These animals, when threatened are able to sting and inject the produced poison directly by their specialized glands.^{2,3} Due to the particularities of some venomous animals, especially scorpions, have adapted to the urban environment and frequent exposure of children, can develop severe conditions, hence, we emphasize the relevance of this study in the pediatric age group.⁴⁻⁷

The lower class population and living in rural areas are the most affected by these poisoning. In 2017, due to its low visibility to the world of this health severity,⁸ accidents caused by venomous animals were officially incorporated into the group of neglected diseases by the World Health Organization (WHO).⁹

Scorpion stings and snakebites are the most prevalent.¹⁰⁻¹² Amongst them, snakebites relate to a higher morbidity/mortality.¹³ However, in Brazilian Poison Centers, an increase in notifications referring to occurrences in urban areas has been observed. Possibly caused by migration of these animals to the outskirts of the cities or the underreporting of cases in rural areas.¹⁴

A study carried out in Pernambuco,⁷ from 2012 to 2014, involving 1242 registered cases of poisoning by these animals in the pediatric age range, showed that the average age of the occurrence was around 5.5 years old. This data is quite significant considering that at this age, children should not be exposed directly to risks when compared to the adult population of rural workers. Which opens space to investigate housing conditions, custody of children under five years old, deforestation resulting from real estate expansion,¹⁵ and early insertion in agricultural work.¹⁶

Given this nationwide scenario, it is necessary to review the epidemiology of poisoning caused by venomous animals to improve prevention programs,^{17,18} adequate management of cases, and reduce the underreporting of this undesirable health issue for the population. This study analyzes data on poisoning caused by venomous animals in children under 15 years old, notified at a state reference center in toxicology.

Methods

A cross-sectional study with analytical component involving secondary data on poisoning notified at the *Centro de Assistência Toxicológica de Pernambuco* (CIATOX/PE) (Poison Center in Pernambuco) from January 2017 to December 2019. This study included notifications of poisoning caused by venomous animals involving children under 15 years old and excluded the duplicated notifications.

The CIATOX/PE is a reference state care service specialized in providing assistance and technical information to health professionals and the population in general by phone on cases of poisoning caused by chemical substances and venomous animals. The patients' data are registered in a specific program called DATATOX,¹⁹ the *Sistema Brasileiro de Registro de Intoxicações dos Centros de Informação e Assistência Toxicológica* (Brazilian Registry System for intoxications and Poisoning Centers). After a phone contact, the CIATox/PE team opens a patient's record with the notification and monitors remotely the notified case until its outcome. The clinical information concerning the hospitalized patient is acquired through contact with the physician in charge of the patient and registered on the electronic patient's record daily.

The DATATOX registrations are available online with limited access to the local administrator of each CIATox. For the analysis, the DATATOX-BI (DATATOX Business Intelligence) was used to export the variables of interest of this research to the *Excel*® program. Incomplete and incorrect information was corrected by reviewing the patients' records.

The analyzed variables were year and month of the notification; age group (categorized in less than one year old, 1 to 4, 5 to 9, 10 to 14 years old); sex; exposure zone (urban, rural, or unknown); exposure location (usual residence, another residence, outdoors/public, school or daycare; workplace, or unknown); time of exposition (00:00a.m. to 05:59a.m.; 06:00a.m. to 11:59am; 12:00pm to 5:59pm; 6:00pm to 11:59pm); animal classification; the time elapsed until the assistance at the health services; severity classification (mild, moderated, severe or null); hospitalization (yes or no), poisoning treatment (serum therapy) and outcome (cure, death, lost on follow up). Based on the twelve *Gerências Regionais de Saúde* (GERES) in Pernambuco (Regional Health Management), where the patients reside was classified according to which they belonged.

For this study, animal classification were categorized as scorpion, snake, spider, lepidopteran (caterpillars), Hymenoptera (stinging insects, wasps, bees), aquatic animals, and other animals. It was possible to classify some genres/species of these animals through photos sent and/or clinical manifestations presented by the patients after the bite. For analysis, the time between the accident and the assistance at the health service was classified as less or equal to one hour and greater than one hour. The classification of severity and the recommendation for serotherapy was based on the "*Manual de Diagnóstico e Tratamento dos Acidentes com Animais Peçonhentos do Ministério da Saúde*" (Manual of Diagnosis and Treatment of Accidents with Venomous Animals by the Ministry of Health) and defined whether serotherapy was indicated by the guidelines.²⁰

The data analysis used the STATA program, version 13.1. Tables were created with the distribution frequencies for each categorical variable. The comparison between eventual outcomes and independent variables used the chi-square test, adopting a significance level of $p \leq 0.05$.

This study was initiated after the letter of consent from the *Secretaria de Saúde do Estado* (SES) (State Secretary of Health) and the approval by the Ethics Committee in Human Research) at IMIP (CAAE 21101219.1.0000.5201) The patient's identity or any other data were preserved.

Results

Of the 2,678 revised reports on notified accidents caused by venomous animals in children under 15 years old that occurred within the three-year period of this study and 1,449 (54.1%) were males. A higher frequency

(70.5%) of accidents caused was observed within the age groups of 5 to 9 and 1 to 4 years old, 36.1% and 34.4%, respectively. Scorpionism (82.8%) was the most frequent accident caused by venomous animals, followed by snakebite (10.8%). Other epidemiological and clinical characteristics are shown in Tables 1 and 2.

Among the scorpions, the most described in the notifications was the one known as the "yellow scorpion of the Northeast".² It was not possible to identify the genre inclassifying snakes in 60.8% of the cases, 29.5% were *Bothrops*, 9.0% *Crotalus*, and 0.7% *Micrurus*.

In general, there were a higher number of notifications between September and October (10.4%), as well as the highest number of scorpion stings (Figure 1).

Scorpion stings were the most frequent in the age groups of 1 to 4 and 5 to 9 years old, while accidents caused by snakes were predominated in the age groups

Table 1

Epidemiological and clinical characteristics of the 2678 accidents caused by venomous animals in children under 15 years old notified at the *Centro de Informação e Assistência Toxicológica de Pernambuco*, (CIATox/PE) (Poison Center in Pernambuco), from 2017 to 2019.

Variables	N	%
Year of notification		
2017	792	29.6
2018	963	36.0
2019	923	34.4
Age group (years)		
<1	82	3.1
01 - 04	922	34.4
05 - 09	966	36.1
10 - 14	708	26.4
Sex		
Male	1449	54.1
Female	1229	45.9
Exposure zone		
Urban	2167	80.9
Rural	393	14.7
Unknown	118	4.4
Exposure location		
Usual residence	2248	83.9
Another residence	30	1.1
Outdoors/public	156	5.8
School or daycare	18	0.7
Workplace	2	0.1
Other places	3	0.1
Unknown	221	8.3
Time of exposition		
00:00a.m. - 05:59a.m.	155	5.8

06:00a.m. - 11:59a.m.	524	19.6
12:00p.m. - 5:59p.m.	732	27.3
6:00p.m. - 11:59p.m.	1267	47.3
Animal classification		
Scorpion	2.216	82.7
Snake	288	10.8
Spider	46	1.7
Lepidopteran*	45	1.7
Hymenopteran*	35	1.3
Aquatic animal	19	0.7
Other animals	29	1.1
Time elapsed between the accident and the assistance at then health services		
Up to 1 hour	1.843	68.8
> 1 hour	830	31.0
Unknown	5	0.2
Severity classification		
Mild	2.332	87.1
Moderated	300	11.2
Severe	43	1.6
Null	3	0.1
Hospitalization		
Yes	2.076	77.5
No	509	19.0
Follow-up lost	83	3.1
Poisoning treatment		
Serum therapy	268	10.0
- Anti scorpion	148	
- Anti snakebite	120	
Outcome		
Cure	2.499	93.0
Death	1	0.4
Follow up losts	178	6.6

*Lepidopteran (caterpillars), Hymenopter (stinging insects, wasps, bees).

of 5 to 9 and 10 to 14 years old (Table 2). There were no differences between sexes within the different age groups ($p = 0.188$).

These accidents were mainly caused with residents in cities that make up the I GERES which corresponds to the Metropolitan Region of Recife (94.6%), including the city of Recife (67.3%) (Figure 2).

Poisoning was predominated among the residents of urban areas (80.9%), which is the principal exposure zone on scorpionism cases (87%) compared to snakebites (40%). Two snake poisoning were notified in the 10 to 14 year old age group, in rural areas, and at workplace (occupational). Habitual residence (83.9%) was the predominant exposure location, especially among children

under one year of age (95.1%). The accidents occurred mainly between 6:00 pm and midnight (47.3%); It was also observed that 50.0% of the accidents caused by scorpions and 40.0% of the accidents caused by snakes also occurred at the same hour.

As for the time elapsed from the accident until the assistance, it was evidenced that 68.8% of the patients had access to the health service within the first hour (45.5% of the accidents caused by snakes and 73.4% by scorpions). In the health service, 78.6% of the patients were symptomatic with the mild form being the initial classification of severity most frequent (87.1%) but most of the patients (77.5%) were hospitalized (Table 1).

Mild and moderate clinical manifestations were predominant. Among the cases of accidents caused by Hymenoptera, 6% were considered severe, compared with snakebites (3.0%) and scorpions (1.5%). In the age group of 10 to 14 years old, the most frequent clinical

manifestations were classified as moderate and severe. Compared with the other age groups, this difference was statistically significant ($p < 0.001$).

Specific serum therapy was administered to 268 (10%) patients (Table 1). Of the 2,216 victims of scorpionism, 148

Table 2

Distribution of the 2678 cases of accidents caused by venomous animals, sex and exposure location in children under 15 years old according to age group, from 2017 to 2019. Centro de Informação e Assistência Toxicológica de Pernambuco (CIATox/PE). (Poison Center in Pernambuco).

Variables	Age group (years)								p
	<1		01 to 04		05 to 09		10 to 14		
	n	%	n	%	n	%	n	%	
Animal classification*	82	3.1	922	34.4	966	36.1	708	26.4	<0.001
Scorpion	63	76.8	815	88.4	803	83.3	535	75.6	
Snake	5	6.1	43	4.7	112	11.6	128	18.1	
Spider	6	7.3	15	1.6	9	0.9	16	2.3	
Lepidopteran*	2	2.4	21	2.3	15	1.6	7	1.0	
Hymenopteran*	4	4.9	7	0.8	14	1.5	10	1.4	
Aquatic animal	1	1.2	4	0.4	5	0.5	9	1.3	
Other animals	1	1.2	17	1.8	8	0.8	3	0.4	
Sex									0.188
Male	50	61.0	512	55.5	499	51.7	388	54.8	
Female	32	39.0	410	44.5	467	48.3	320	45.2	
Exposure location									<0.001
Usual residence	78	95.1	802	87.0	640	83.1	565	79.8	
Other places	4	4.9	120	13.0	163	16.9	143	20.2	

*Lepidopteran (caterpillars), Hymenopteran (stinging insects, wasps, bees).

Figure 1

Distribution of accidents, in children under 15 years old, according to the classification of venomous animals and the months of occurrence. Left Y axis – matches notifications by scorpions; Right Y axis – corresponds to the other animals studied. Centro de Informação e Assistência Toxicológica de Pernambuco (Poison Center in Pernambuco, CIATox/PE). 2017 to 2019.

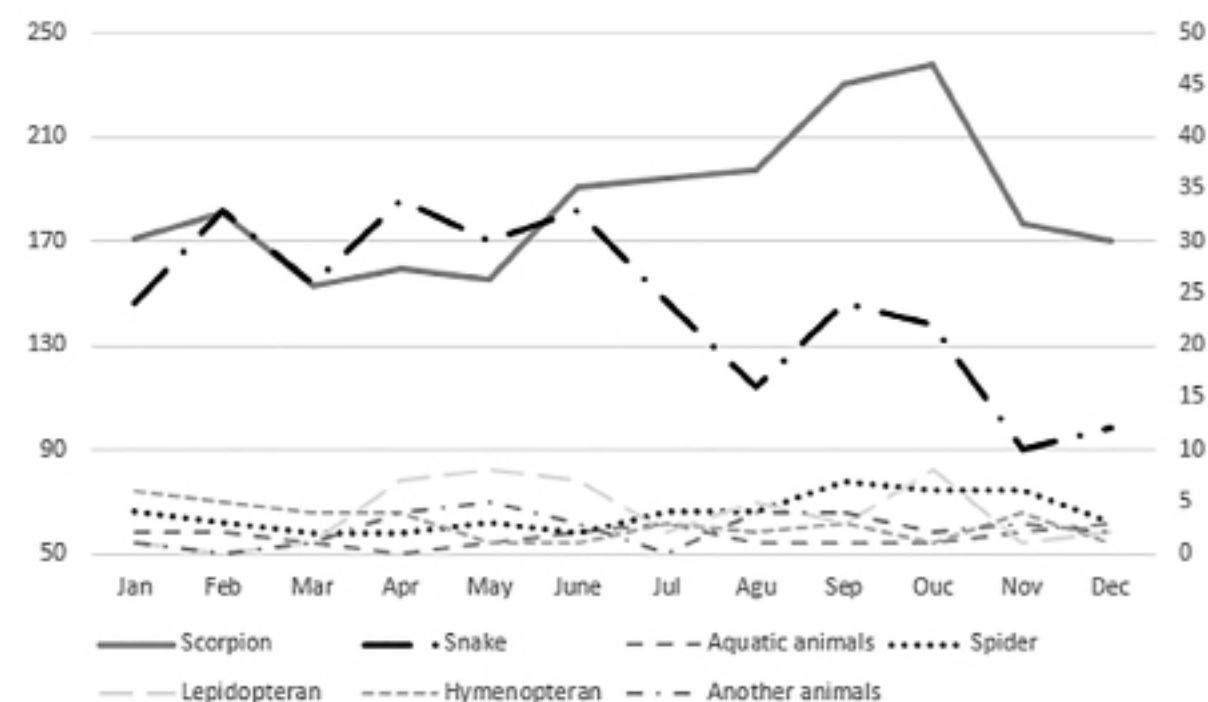
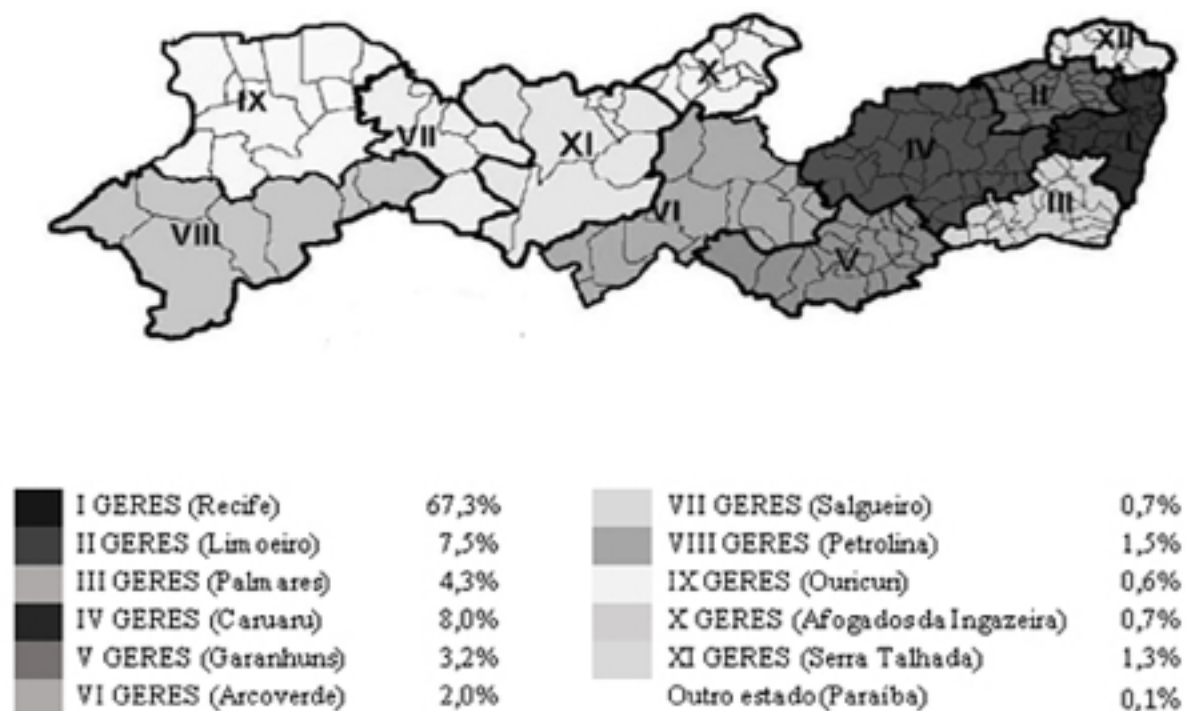


Figure 2

Geographical distribution of cases of accidents caused by venomous animals in children and adolescents under 15 years old according to the Gerências Regionais de Saúde (GERES) (Regional Health Management) and their respective headquarters, in the tState of Pernambuco between 2017 and 2019. Centro de Informação e Assistência Toxicológica de Pernambuco, (CIATox/PE) (Poison Center in Pernambuco).



(6.6%) received specific serum, and 24 of them (16.2%) had no indication for the use since they were clinically classified as mild cases. Of the 288 victims of snakebite, 120 (41.6%) received specific serum therapy and in all the cases, the indication was considered adequate.

Excluding follow-up losses, the cure was reported in 93% of the cases, one death occurred of a scorpion sting (Table 1).

Discussion

The accidents caused by venomous animals among children under 15 years of age in the state of Pernambuco occurred more frequently in the metropolitan region of Recife and the state capital, the age groups of 1 to 4 and 5 to 9 years old, the urban area, the child's residence and mainly were caused by scorpions.

Scorpion accidents were the most reported, similar to other studies that analyzed different regions in Brazil.^{13,18,21} Studies report an increase in accidents caused by scorpions in urban areas due to urban development disorder. In Brazil, more than 160 species of scorpions are known. However, the species of medical interest belong to the *Tityus* genre. *Tityus stigmurus*, also known as the "Northeast Yellow Scorpion",² is associated with the most accidents in the Northeast of the country. It is characterized

by the dark yellow trunk, in addition to a black triangle on the cephalothorax, a dark longitudinal median band, and dark lateral spots.²⁰

In this present study, although, there was a higher overall frequency of accidents involving males, this difference was not statistically relevant. This result was similar to what was found, in children under the age of 15, in the study involving the annual average of cases of poisoning by snakes, scorpions, and spiders in all Brazilian regions.¹³

It evidenced that the accidents occurred mainly in the age groups of 1 to 4 and 5 to 9 years old. A study was carried out in the period of 2009 to 2013¹³ evaluated the epidemiology of poisoning by scorpions, snakes, and spiders in Brazil, and when comparing to the population in our study, the highest annual average reported was between 10 and 14 years old.

Among the animals analyzed, scorpions are easily found in urban homes. Accidents caused by scorpion stings involving small children inside homes may be related to the disordered deforestation and urbanization that occurred in the recent decades, the lifestyle of the scorpion, in addition to the lack of basic sanitation and sanitary education.²¹⁻²³ This scenario draws attention to the necessity of implementing public policies aiming

for basic sanitation, health education since scorpionism is a preventable, neglected injury.

Aside from the high frequency of accidents in the children and adolescents' usual homes, there was also a greater occurrence at night; which is the period with the least surveillance by the parents and caregivers, coinciding with the time that the scorpions search for food.²⁰

The frequency of snakebites was higher in the age groups of 5 to 9 and 10 to 14 years old. Among the notified cases, in the age group of 10 to 14 years old, two occurred at the workplace, in the rural area, drawing attention to the vulnerability of these children/adolescents, probably subjected to child labor, which continues to be a reality in Brazil and in the developing world.^{16,24} Accidents caused by Bothrops are the most frequent snakebites in Brazil, including in the Northeast. Bothrops snake species occupy all the main ecosystems in Brazil.²⁵

Although, accidents caused by spiders are considered a public health problem, especially in the South and Southeast of Brazil,^{13,20} they were infrequent in Pernambuco.

Accidents caused by bees were also uncommon in this study. However, they were more severe when compared to scorpion stings and snakebites. Bees belong to the *Hymenoptera* order and are the only insects with real stingers, which can cause serious accidents and death, either by anaphylactic reaction or by poisoning resulting from multiple stings.²⁰

Overall, mild clinical conditions were the most frequent, due to the predominance of scorpionism; in agreement with another study carried out previously in Pernambuco.²⁶ Moderate and severe clinical manifestations occurred mainly among adolescents aged 10 to 14 years old, the age group that increased its accident causes by snakes. The greater independence of adolescents to travel and explore environments where snakes are, could justify these occurrences.

Of the patients studied, about a third did not have access to the health unit in the first hour after the accident. Following the guidelines of the *Manual de Diagnóstico e Tratamento dos Acidentes com Animais Peçonhentos do Ministério da Saúde*²⁰ (Manual on Diagnosis and Treatment of Accidents caused by Venomous Animals of the Ministry of Health), all the 120 victims who got snakebites received snake antivenom and were correctly indicated for the serum therapy, since the bites had clinical evidence of the occurrence of poisoning. However, when analyzing the 148 victims of scorpionism who received serum therapy, 24 (16.2%) were classified as mild cases, thus they did not have any indication for this therapy. Given this scenario, it is suggested the necessity to update these responsible professionals' training for administering serum therapy, the importance of the correct

clinical classification of severity at the time of admission, and the correct notification of the cases.⁸

The cure was the most frequent outcome and it is in agreement with literature.²⁶ There was a record of one death of a male patient, aged between 1 and 4 years old, stung by a scorpion.

This study showed a high frequency of accidents in the urban area of the metropolitan region of Recife that makes up I GERES, and which, according to the population estimated for 2020, representing more than 40% of the population in the state of Pernambuco,^{27,28} likely consequence of population migration over the years. In this region, there is a greater concentration of state health services, which would facilitate the population's access to care as well as the notification of these accidents.

Among the limitations of this study, we highlight that the data were solely from notifications from the *Centro de Toxicologia de Pernambuco* (Poison Center in Pernambuco) with probable underreporting. Thus, we emphasize the necessity to publicize the service provided to the population by this poison center in the State, especially in other *Gerencias Regionais de Saúde* (Regional Health Management) that do not cover the State capital. The lack of knowledge of the population regarding the provision of specialized healthcare teleconsultation in case of accidents, or even the low severity of some poisoning that do not evoke the need to search for health centers, could justify the existing underreporting.

Unplanned urbanization and the absence of basic sanitation may justify the increasing notifications on scorpion stings and snakebites in the urban area. Given the significant risk observed in the home environment for children aged 1 to 4 and 5 to 9 years old, the need to instruct responsible adults rises. From the two suspected cases of child labor, in the age group of 10 to 14 years old, victims of snakebite in the working environment, the necessity of a rigorous investigation of this reality which still exists in our country is reiterated. The failures concerning the clinical classification of poisoning by venomous animals and the proposed treatment reinforce the need to widen the availability of serum in the referred units and the proper knowledge of the health professionals about its correct indication.

Author's contribution

Albuquerque MCA, Amorim MLP, Mello MJG, Lyra Filho CRN participated in the study design and planning; acquisition, analysis and interpretation of data, as well as in the writing and elaboration of the article, and in the critical intellectual review. Lins IBL, Lima PVC participated in data acquisition and analysis, as well as critical intellectual review. All authors approved the final

version of the manuscript. The authors declare no conflict of interest.

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Received on November 6, 2020

Final version presented on September 17, 2021

Approved on December 15, 2021