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Healing with animals in a semiarid northeastern area of Brazil

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Abstract This study presents information on the use of medicinal animals in a semiarid area of northeast Brazil, a region where animals have recognized importance in local popular medicine. The information on the use of animals for medicinal purposes was obtained through semi-structured questionnaires, complemented by free interviews and informal conversations. The results obtained showed that the residents of the area studied utilize a considerable richness of animal species ($n = 42$) for medicinal purposes, as occurs in other areas of Brazil's semiarid region, demonstrating that zootherapy represents an alternative form of health care that is important to the inhabitants of the region. There is a need for new investigations on medicinal fauna, aimed at promoting the sustainable use of eventual medicinal species and preserving popular knowledge associated with the use of animal species.

Keywords Caatinga · Ethnozoology · Medicinal animals · Zootherapy

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1 Introduction

Throughout history, humans have interacted with the fauna around them, benefitting from products derived from animals for various purposes (Cragg and Newman 2001). Some of the oldest ways of utilizing fauna are related to the use of animal products for the treatment of diseases of humans and their domestic animals (Alves et al. 2013a, b; Ferreira et al. 2012, 2013; Souto et al. 2011a, b, 2013). Such uses are present in traditional medicine systems of various countries and have evident relevance from historical, sociocultural, environmental and economic points of view (Alves et al. 2010; Apaza et al. 2003; Kang and Phipps 2003; Martinez 2013; Soewu 2008; Whiting et al. 2011, 2013).

Brazil harbors a rich biological diversity (Alves et al. 2009a), as well as a rich sociodiversity, represented by more than 200 indigenous peoples and local communities (quilombolas, caicaras, seringueiros, etc.), which brings together a wide knowledge of the traditional use of biodiversity (Diegues et al. 1999). This has resulted in a rich healthcare system characterized by: (i) rich diversity of medicinal species, (ii) plasticity in forms of use and (iii) large number of diseases treated by animals (Alves et al. 2013b).

Currently, at least 354 species of animals are utilized for medicinal purposes in Brazil (Alves et al. 2013b). From these species, parts of the body, products of their metabolism (such as body secretions) and construction materials (nests or cocoons) are utilized in the preparation of traditional medications (Alves 2009; Barros et al. 2012; Costa-Neto 1999a; Ferreira et al. 2009a).

In the semiarid region of northeastern Brazil, animals are widely used in popular medicine and play a significant role in healing practices, both in rural (Alves et al. 2008b, 2011, 2012b; Bezerra et al. 2013; Costa-Neto 1999b, 2000; Costa-Neto and Oliveira 2000; Ferreira et al. 2009a; Moura and Marques 2008) and in urban areas (Almeida and Albuquerque 2002; Alves et al. 2008a, 2010; Costa-Neto 1999a; Ferreira et al. 2009b). In addition to its use for treatment of human diseases, zootherapeutic products are used for the treatment of livestock diseases (Barboza et al. 2007; Confessor et al. 2009; Souto et al. 2011a, b, 2012a, b). Previous studies show that in the semiarid region of Brazil, zootherapy forms an integral part of the local culture, and information about animals and their uses are passed from generation to generation through oral folk lore (Alves 2009).

Despite that studies on the use of animals in popular medicine have intensified in the last years, they are still very few compared to works dealing with medicinal plants. Such studies are essential, especially considering the ecological implications, as well as pharmacological and for public health of users of these folk remedies. Most studies on medicinal animals were undertaken in isolated communities (often without access to health services) or in public markets where medicinal products derived from animals are sold. In view of this scenario, the present work addressed to investigate the use of medicinal animals in a human population assisted by community health workers, which are professionals linked to the Family Health Program of the Brazilian government. Our hypothesis states that even in communities assisted by health services untaken by the federal government, the use of medicinal animals continues as an alternative therapy and therefore should be considered in public health programs, which are more focused on medicinal plants, when addresses the folk medicine.

2 Methods

2.1 Study area

Localized in a harsh mesoregion and in the microregion of Brejo Paraibano, the city of Alagoa Nova has an area of 122.255 km^2, which is supplied by the Mamanguape and Riachão rivers. Because of its location, rains are abundant, reaching a mean of 1400 mm annually. In the region, temperatures vary between 13 and 32 °C. The vegetation is formed by subdeciduous and deciduous forests, composing what is known as the *Caatinga,* a characteristic biome of northeast Brazil. The climate is tropical rainy with dry summer (BRASIL 2006).

Data from the IBGE (Instituto Brasileiro de Geografia e Estatística) for 2010 reveal that the municipality had a population of 19,681 inhabitants, with a demographic density of 160.98 (inhab./km^2). The population is distributed as follows: 9794 persons in the urban zone and 9887 persons in the rural zone. Its economy is based on agriculture, particularly bananas, sugarcane, sweet potatoes, tangerines, mangoes and oranges, among others.

Field work was done in the period of December 2009–December 2010, that is, visiting homes in the rural communities and urban zone in the municipality of Alagoa Nova. The sample was composed of people who used medicinal animals and seen by healthcare agents of Alagoa Nova. Considering this sample universe, 300 users of medicinal animals who were willing to participate in the study were interviewed. Of these, a total of 81 % of respondents are female, while (19 % are male). The ages of participants ranged from 20 to 89 years, and the majority ($n = 135$, 59 %) falls within the age category 30–49 years.

The information on the use of animals for medicinal purposes was obtained through semi-structured questionnaires, complemented by free interviews and informal conversations (Huntington 2000). Data were collected with the collaboration of community healthcare agents, who regularly visit the homes of the local population and helped with the administration of the questionnaires. The questionnaires dealt with the following aspects: local name of medicinal animal, parts used, diseases treated, modes of preparation and use, ways of obtaining the zootherapeutic resources, conditions and storage places, form of acquisition of knowledge about the use of medicinal animals and reason why the interviewees used medicinal animals. With respect to intellectual property rights, all interviewees gave permission for the recording of information. The present study was approved by the Ethics Committee for Research with Humans of the Universidade Estadual da Paraiba.

The vernacular names of species were recorded as cited by the interviewees. In many cases, the identification of the animals was established by directly examining the whole animal or their usable parts during the interviews. In general, the animals were identified in the following ways: (1) analysis of specimens donated by the interviewees, (2) analysis of photographs of animals (or of their parts) done during the interviews and (3) through vernacular names, with the help of taxonomists familiar with the fauna of the study area. In the few cases where identification was not possible by one of the aforementioned methods, by-parts or the entire animal (small size ones such as insects or termites) of each species were collected for later identification. The authors of the manuscript, four of whom are Ph.D. in zoology, carried out the identification, in most cases.

2.2 Data analysis

For the data analysis, the use value (adapted from Phillips et al. (1994)), as a quantitative method demonstrating the relative importance of each species, was calculated as:

$$\mathrm{UV} = \sum U/n$$

where UV is the use value of a species: U the number of citations per species and n is the number of informants. The use value of each species is based solely on the importance attributed by the informants themselves and does not depend on any evaluation of the researcher.

3 Results and discussion

In the study area, the medicinal use of animals and their products appeared to be a common practice, a situation evidenced by the recording of the use of 42 species of animals for therapeutic purposes (31 vertebrates and 11 invertebrates), distributed in 32 families. The taxonomic categories with the largest number of medicinal species cited were: mammals (15 species), insects (8 species) and reptiles and birds (both with 7 species) (see Table 1). The marked richness of medicinal species (41 species) inventoried in the study area, together with data from previous studies, reinforces that zootherapeutic practices are widespread in various regions of Brazil and involve different animal taxa. Examples are the works of Branch and Silva (1983), who recorded 33 species of medicinal animals in Alter do Chão, Pará, and Rodrigues (2006), who reported the use of 29 species in Parque Nacional de Jaú, Amazonas. In Ceará, in the city of Crato, Ferreira et al. (2009a) described the use of 29 medicinal species. In Paraíba, 23 species were cited as medicinal in the city of Soledade (Alves et al. 2008a), while 51 species were recorded in the municipality of Queimadas (Alves et al. 2011). Barros et al. (2012) reported the use of 31 species of fauna utilized for therapeutic practices in the state of Pará. Alves and Rosa (2006, 2007) reported the following uses: 74 species in Mamanguape in Paraíba, 57 species in Raposa in Maranhão, 54 species in Ilha do Marajó and 46 species in Cajueiro da Praia in Piauí.

Considering the list of medicinal fauna mentioned in the study area and of other studies, we found that some species are utilized in various regions of Brazil. Some examples are the lizards *Salvator merianae* Duméril & Bibron, 1839, *Ovis aries* Linnaeus, 1758, and *Apis mellifera* Linnaeus, 1758, among others. It should be noted that there are even cases of medicinal animals that are also utilized in the popular medicine of other countries, including wild and domestic species. In Sudan, for example, *A. mellifera* is used for the treatment of gastric ulcers, *Capra hircus* (Linnaeus, 1758) (goat) for dermatitis, *Capra hircus* (Linnaeus, 1758) for cough and *O. aries* for gingivitis (El-Kamali 2000). In Mexico, *Crotalus durissus* Linnaeus, 1758, and *Coragyps atratus* (Bechstein, 1793) (vulture) are utilized for helping in childbirth and for treating shortness of breath, swelling and epileptic attack (Vázquez et al. 2006). In India, *Pavo cristatus* Linnaeus, 1758 (peacock), is used for treating ear infections and muscle pain, and *Sus scrofa* (Linnaeus, 1758) (pig) and *G. domesticus* are utilized for the treatment of rheumatism, snake bite, burns and sexual impotence (Kakati et al. 2006; Mahawar and Jaroli 2008; Negi and Palyal 2007).

In the area studied, the species with the highest number of citations were: *Melipona scutellaris* Latreille, 1811 ($n = 261$), *S. merianae* ($n = 253$), *G. domesticus* ($n = 206$) and *Bos taurus* Linnaeus, 1758 ($n = 197$). These medicinal species have been recorded in

Table 1 Species of animals used for medical purposes in surveyed area

Family/species/local name	Number of citations	Use value	Parts used and method of use	Disease or illness
MOLLUSCA				
Helicidae				
Megalobulimus sp.—Snail	36	0.12	Visceral mass (1)	Warts and cracks in the feet
ANNELIDA				
Lumbricidae				
Lumbricus sp.—Earthworm	17	0.05	Whole animal (2)	Alcoholism
INSECTA				
Apidae				
Melipona scutellaris Latreille, 1811—Stingless bee	261	0.87	Honey (3 and 4)	Flu, fatigue, cancer, bronchitis, cough and ameba
Apis mellifera Linnaeus, 1758—Honey bee	33	0.11	Honey (3)	Flu, asthma and ameba
Tetragonisca angustula (Latreille, 1825)—Soldier bees	79	0.26	Honey (5)	Earache
Chrysomelidae				
Pachymerus nucleorum Fabricius, 1792—Coconut Borer	63	0.21	Whole larval (6)	Warts
Formicidae				
Atta cephalotes (Linnaeus, 1758)—Leaf cutting ant	93	0.31	Abdomen (7)	Sore throat
Dinoponera quadriceps Kempf, 1971—Bullet ant	41	0.13	Whole animal (8)	Asthma
Termitidae				
Isoptera—Termites	196	0.65	Whole animal (9)	Bronchitis, asthma and flu
Vespidae				
Hymenoptera—Wasp	54	0.18	Nest with larvae(10)	Mumps
Blattidae				
Periplaneta americana (Linnaeus, 1758)—Cockroach	2	0.006	Whole animal (8)	Schistosomiasis and alcoholism
PISCES				
Gymnotidae				

Table 1 continued

Family/species/local name	Number of citations	Use value	Parts used and method of use	Disease or illness
Electroporus sp.—Electric eel	13	0.04	Fat (6)	Rheumatism, cramp and muscular pain
Gadidae				
Gadus sp.—Cod	34	0.11	Liver oil (3), tail (8) and skin (10)	Weakness in the bones, headache and injuries of animals
AMPHIBIA				
Leptodactylus pentadactylus (Laurenti, 1768)—South American Bullfrog	92	0.30	Fat (6) and meat (11)	Sore throat and asthma
REPTILIA				
Teiidae				
Salvator merianae Duméril & Bibron, 1839—Black-and-white Tegu	253	0.84	Fat (6 and 12)	Sore throat, asthma and furunculosis
Testudinidae				
Chelonoidis carbonaria (Spix, 1824)—Red-footed tortoise	11	0.03	Eggs (11) and whole animal (1)	Fatigue and asthma
Gekkonidae				
Hemidactylus mabouia (Moreau de Jonnes, 1818)—Moreau's Tropical House Gecko	1	0.03	Whole animal (12)	Sore throat
Tropiduridae				
Tropidurus hispidus (Spix 1825)—Peters' Lava Lizard	38	0.12	Whole animal (1 and 12)	Sore throat, pityriasis, alcoholism and warts
Chelidae				
Phrynops sp.—Water tortoise	107	0.35	Fat (3, 6 and 12)	Sore throat, injuries of animals (estrepada), furunculosis and asthma
Viperidae				
Crotalus durissus Linnaeus, 1758—Cascabel Rattlesnake	16	0.05	Rattle (8)	Asthma
Iguanidae				
Iguana iguana (Linnaeus, 1758)—Common green iguana	8	0.02	Bones (33)	Injuries of animals (estrepada)
BIRDS				

Table 1 continued

Family/species/local name	Number of citations	Use value	Parts used and method of use	Disease or illness
Phasianidae				
Gallus domesticus (Linnaeus, 1758)—Chicken	206	0.68	Fat (3, 5, 6 and 12) and skin gizzard (8)	Furunculosis, nasal obstruction, sore throat, asthma, earache and congestion
Phasianidae				
Pavo cristatus Linnaeus, 1758—Indian Peafowl	21	0.07	Feathers (8)	Asthma
Rheidae				
Rhea americana (Linnaeus, 1758)—Greater rhea	19	0.06	Fat (3 and 6)	Rheumatism, backache and asthma
Cathartidae				
Coragyps atratus (Bechstein, 1783)—Black vulture	12	0.04	Liver	Alcoholism
Phasianidae				
Meleagris gallopavo Linnaeus 1758—Wild turkey	8	0.02	Feathers (8)	Asthma
Psittacidae				
Amazona aestiva (Linnaeus, 1758)—Turquoise-fronted Amazon	6	0.02	Feces (5)	Earache
Anatidae				
Anas sp.—Duck	49	0.16	Eggs (7)	Weakness and fatigue
MAMMALS				
Didelphidae				
Didelphis albiventris Lund, 1840—White-eared opossum	22	0.07	Fat (6)	Rheumatism
Canidae				
Cerdocyon thous (Linnaeus, 1766)—Crab-eating fox	78	0.26	Fat (6) and liver (11)	Rheumatism
Canis familiaris Linnaeus, 1758—Dog	15	0.05	Feces (8)	Measles, disorders after parturition and asthma
Bovidae				
Ovis aries Linnaeus, 1758—Sheep	190	0.63	Fat (6)	Rheumatism, arthritis, torsion, acne and furunculosis

Table 1 continued

Family/species/local name	Number of citations	Use value	Parts used and method of use	Disease or illness
Bos taurus Linnaeus, 1758—Cow	180	0.60	Milk (3, 6) saliva (14), urine (10), feces (8), hoof (15), marrow (3), blood (11) and liver (11)	Mastitis, furunculosis, bronchitis, sinusitis, flu, alcoholism, toothache, chilblain, sore throat, nosebleed, thrombosis and anemia
Capra hircus (Linnaeus, 1758)—Domestic goat	10	0.03	Saliva (12)	Hoarseness
Dasypodidae				
Euphractus sexcinctus (Linnaeus, 1758)—Six-banded armadillo	28	0.09	Tail (5) and fat (6)	Earache and wounds
Suidae				
Sus domesticus Erxleben, 1777—Pig	103	0.34	Fat (6 and 16)	Wounds, furunculosis, burning and body pain
Trichechidae				
Trichechus manatus Linnaeus, 1758—Manatee	23	0.07	Fat (6)	Rheumatism, arthrosis, arthritis, dislocation and strain
Trichecus inunguis (Natterer, 1883)—Amazon manatee	23	0.07	Fat (6)	Rheumatism, arthrosis, arthritis, dislocation and strain
Leporidae				
Sylvilagus brasiliensis (Linnaeus, 1758)—Tapeti	18	0.06	Pelage (17)	Burning
Mephitidae				
Conepatus semistriatus (Boddaert, 1785)—*Striped Hog-nosed Skunk*	27	0.09	Fat (3)	Asthma
Equidae				
Equus asinus Linnaeus, 1758—Donkey	42	0.14	Milk (11)	Intestinal infections, allergic children to cow's milk and asthma
Felidae				

Table 1 continued

Family/species/local name	Number of citations	Use value	Parts used and method of use	Disease or illness
Felis catus Linnaeus, 1758—Cat	6	0.02	Pelage (8)	Asthma

(1) Rub on the affected area; (2) infusion in combination with alcoholic and taken as a drink; (3) taking mixed with coffee or tea; (4) beverage ('garrafada'); (5) rub on the ear; (6) to massage the ointment in affected area; (7) ingestion of the crude part; (8) tea; (9) homemade syrup; (10) putting on the affected area; (11) ingestion of the cooked part; (12) gargling water from boiled animal or its body parts; (13) powder, to be spread on the affected area; (14) ingestion ingested and/or mixed with food; (15) inhalation of the powder; (16) sticking plaster (patches) made by plants leaves; (17) pelage placed on the affected area; (18) leave/give the food leftovers to the animal

various places in Brazil (Alves and Alves 2011; Alves et al. 2009b, 2013b; Ferreira et al. 2009a, b, c, 2010, 2012, 2013; Oliveira et al. 2010), demonstrating their cultural importance in the scope of Brazilian traditional medicine.

The value use (VU) of zootherapeutic resources ranged from 0.003 to 0.87. Most species exhibited low use values (Table 1), but some species has the high use value, including *M. scutellaris* (0.87), followed by *S. merianae* (0.84), *G. domesticus* (0.68) and *O. aries* (0.63). It is not surprising, since they also had high value use in other studies of medicinal animals registered in different locations of Brazil, both in municipalities and in rural areas (Alves and Rosa 2007, 2010; Ferreira et al. 2009a, b, 2012, 2013; Oliveira et al. 2010). The species *S. merianae,* for instance, represents the main cinegetic reptile of the semiarid region of Brazil (Alves et al. 2012a), and in traditional folk medicine of this region, its fat is one of the most widely used zootherapeutic products in Caatinga, where it is used in the treatment of at least eight diseases.

The majority of species recorded are wild (32 species, 76.2 %). Only 10 domestic animals of medicinal use were mentioned, namely *Canis familiaris* Linnaeus, 1758, *O. aries*, *B. taurus*, *C. hircus*, *Sus domesticus* Erxleben, 1777, *Equus asinus* Linnaeus, 1758, *Felis catus* Linnaeus, 1758, *G. domesticus*, *P. cristatus* and *Meleagris gallopavo* Linnaeus, 1758. The use of such species indicates the European influence on Brazilian traditional medicine, since as pointed out by Almeida (2007); the majority of domestic species utilized for medicinal purposes are of European origin and did not originate from traditional medicine practices of native populations of Brazil. This suggestion is in line with earlier studies that showed that some of these species have been used for centuries in European countries. On the other hand, the native species of Brazil have been commonly recorded between indigenous and quilombola communities. Such findings reinforce that the use of animals in traditional medicine of Brazil has cultural influences of indigenous people, blacks and Europeans (Alves et al. 2013b; Rodrigues 2006).

The high value use of some domestic species (*G. domesticus*—UV = 0.68, *O. aries*—UV = 0.63, *B. taurus*—UV = 0.60 e *S. domesticus*—UV = 0.34) suggests that zootherapeutic products of them are most commonly used. This situation may be influenced by the fact that capturing and using wild animals in Brazil is an illegal activity leading the usages clandestinely, unlike livestock-derived products, which are easily accessible and without legal implications. Medicinal products derived from domestic animals (e.g., fat, skins, and horns) are generally inedible, being discarded so that its utilization would be a form to optimize the use of these resources. From a conservation perspective, the use of domestic species is positive as it would reduce the pressure on wild species. As pointed out by previous studies (Alves et al. 2013b; Ferreira et al. 2013), there are several endangered wild species which are used in Brazilian folk medicine, and therefore management strategies should consider this fauna usage as an additional pressure, and in this case, the replacement of wildlife-derived products by domestic animals products and medicinal plants could represent an alternative to reduce the medicinal use of endangered species or under increased exploration pressure.

According to the informants, some zootherapeutic products are bought. Among these, the interviewees cited the purchase of the fat of sheep (*O. aries*) and manatee (*Trichecus* spp). The medicinal sale of animals is a common activity in various cities in Brazil, particularly in public markets, places where knowledge about medicinal species of the Brazilian fauna is common (Alves and Rosa 2010; Ferreira et al. 2012, 2013).

The informants cited various forms of preparation and administration of zootherapeutic resources. Hard parts of animals are dried in the sun or grilled, macerated or grated, resulting in a powder, which is used in the preparation of teas, ingested with food, or

inhaled. Honey is kept in bottles or small flasks and used when needed in food as well as for medicinal purposes, where they can be administered pure or combined with plants (lemon and mint). Metabolic secretions are utilized as ointments, and parts such as meat and eggs are administered raw or cooked. Fat and oils are cooked and then stored in various types of containers such as glass or plastic bottles; they are used for massages, gargling and teas.

According to the informants, 49 diseases and/or symptoms are treated by the administration of products from medicinal animals. The data obtained indicated the greatest utilization of animals (17 species) for the treatment of asthma, corroborating other studies that have demonstrated that this disease, as well as other illnesses associated with the respiratory tract, is among those most treated with zootherapeutic products in Brazil (Alves et al. 2013b; Ferreira et al. 2013). As expected, the categories with the highest number of citations in the area studied were: respiratory tract diseases (732), musculoskeletal and connective tissue diseases (587), wounds, poisonings and some other consequences of external causes (369), and diseases of the blood and hematopoietic organs and some immune disturbances (368).

The results obtained showed that the residents of the area studied utilize a considerable richness of animal species for medicinal purposes, as occurs in other areas of Brazil's semiarid region, demonstrating that zootherapy represents an alternative form of health care that is important to the inhabitants of the region, even in areas that are assisted by a health service provided by the government. The widespread use of animal products in folk medicine shows that this therapeutic alternative should be further investigated in a pharmacological point of view, in order to elucidate the potential of medicinal animals used. Like medicinal plants, medicinal animals represent an interesting area of study for bioprospection (Alves and Albuquerque 2013; Ferreira et al. 2014; Rose et al. 2012), but bioactive compounds derived from animals have been less studied relative to medicinal plants (Ferreira et al. 2014; Harvey 2008). In this scenario, the traditional use of natural resources may indicate the presence of biologically active components, as historic and maintained use of naturally occurring compounds often has a scientific underpinning (Oliveira et al. 2010). The second most cited species (*S. merianae*) in this research demonstrates this situation. In a recent study, Ferreira et al. (2010) evaluated the anti-inflammatory properties of topical fat use of this species and the results indicated that in in vivo models, there was an edema reduction in the ears of test subjects in which this zootherapy has been tested. Insect by-products are also very important as potential sources of drugs (Alves and Albuquerque 2013; Dossey 2010). A number of laboratory studies, for example, have demonstrated significant anti-bacterial activity in honey, especially of *Apis* sp. (Molan 1999), which includes one of the species recorded in the survey area. Park et al. (2000) found anticancer and anti-HIV activities in ethanolic extracts of propolis from *Apis mellifera* collected in different parts of Brazil. Ethnozoological studies on medicinal animals, like ours, investigating the popular knowledge of medicinal animals, can be useful as a source of information for bioprospection as they may represent a shortcut to modern drug discovery through providing a short list of potential sources.

Another important perspective related to the use of medicinal animals concerns to public health. It is known that some species can transmit disease to humans through the consumption of its medicinal by-products. Armadillos, for example, are widely used in folk medicine and are a natural reservoir of etiological agents of several zoonotic diseases that affect humans such as leprosy, trichinosis, coccidioidomycosis or Valley Fever, Chaga's disease and typhus (Silva et al. 2005). In the state of Piauí, northeast Brazil, more than 100 occurrences of pulmonary mycosis were recorded in 40 municipalities over the state. This

disease is transmitted by a soil fungus present in the armadillo's organism, a very consumed and marketed animal in Brazil's northeast region. Whether for food or medical purpose the consumption of armadillos can be a vector of various human diseases. In our study, we found the medicinal use of six-banded armadillo, *Euphractus sexcinctus* (Linnaeus, 1758), and this figures as an alert for users of this popular remedy.

Our results reinforce the importance of using animal products in folk medicine and its cultural, environmental, pharmaceutical and public health implications. There is a need for new investigations on medicinal fauna, aimed at promoting the sustainable use of eventual medicinal species and preserving popular knowledge associated with the use of animal species. Accordingly, studies with a multidisciplinary approach, which involve social, cultural, economic, clinical and environmental aspects, are essential to broadening our knowledge of this important use of fauna.

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