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A survey on Non-Venomous Snakes in Kashan (Central Iran)

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ABSTRACT

Due to the importance of animal bites in terms of health impacts , potential medical consequences, and the necessity of proper differentiation between venomous and non-venomous snake species, this study was conducted with the aim of identifying non-venomous, or fangless snakes, in Kashan as a major city in central Iran during a three-year period (2010-2012). A total of 41 snakes were collected; 32(78%) Ravergier`s racer [*Hemorrhois* (Coluber) *ravergieri*], 3 (7%) Zebra Snake (*Spalerosophis microlepis*), 3 (7%) Braid Snake (*Platyceps* (Coluber) *rhodorachis*), one (2%) Desert Sand Boa (*Eryxmiliaris*), one (2%) Dice Snake (*Natrixtessellata*), and one (2%) Black-headed Snake (*Rhynchocalamus melanocephalus*). All snakes were taxonomically identified and confirmed to genus and species. All of the snakes were classified as Aglyphic with 97.5% belonging to the Colubridae family, and 2.5% to the Boidae family.Totally,six non-venomous species were identified, and *Hemorrhois* (Coluber) *ravergieri* was observed as the most abundant species in the city of Kashan, which is geographically located at the center of Iran. Although envenomation is usually a specific complication associated with venomous snakes, bacterial infections are a potential significant medical complication associated with both venomous and non-venomous snakebites.

Key words: Snakes, Venomous, Non-Venomous, Kashan

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1. INTRODUCTION

Diversity in climate and being a geographical communicating bridge between different continents including Asia, Europe and Africa has made Iran a rich source of various reptile species (1). Snakes are an important suborder of the order Squamata (scaled reptiles), the Alethinophidia, which are easily recognizable to humans in terms of their morphological and behavioral characteristics. Approximately 3,700 types of snakes have been identified in a wide variety of habitats in the world. Given this variety and wide distribution there is frequently the possibility of human encounters with snakes and resultant bites (2). Geographically, the largest number of snakebite deaths occurs in South and South East Asia, and sub-Saharan Africa (3). The Iranian people have always been at risk of animal bites and particularly snakebite, which is known as an important medical problem in Iran. Vast expanses of different species of venomous and non-venomous snakes are located in Iran, ranging from the southern islands situated in the Persian

Gulf to the northern regions of the country (4, 5). A large number of cases of snake bite have been reported from these different regions of Iran each year (6). In general, species of snakes are distributed throughout the country's varying habitats, especially in mountainous and semi-mountainous areas, and in particular large expanses of desert (7). At least 83 different species of snakes, including 27 venomous species, 11 species of semi-venomous species (rear-fanged or non-front-fanged snakes), and 45 species of non-venomous snakes live in terrestrial or aquatic environments (8, 9). Iran's venomous snakes possess fangs, hollow-tube-shaped teeth that are located at the anterior part of the mouth and upper jaw connecting to a venom gland. Most of the venomous snakes species native to Iran are vipers (family Viperidae), frequently characterized by a triangular head with a distinctly defined neck. Their tails are usually short, and their movement and locomotion is typically sluggish, except when striking to bite. In some species of Viperid snakes, there is an orifice between the eyes; and nose that is easily recognizable, and appears like a second nasal opening. These snakes are classified as pit vipers (subfamily Crotalinae). The true vipers (subfamily Viperinae) do not possess the second facial orifice (or pit), which is an infrared heat-sensing organ. The majority of viper and pit viper species have tiny, asymmetrical scales on head, but a few have symmetrical scales. Geographically, the dispersion of different snake species varies based on structural habitat, plant growth, and other environmental conditions. Non-native snakes, those observed in habitat where they are not expected to be found, are seen less frequently in these specific habitats except during periods of seasonal migration. Snakes of the family Colubridaecan been subdivided into two groups based on their dentition. Species considered non-venomous have simple round, uniform teeth that are solid, and without grooves or a lumen, and are referred to as aglyphus. Their teeth are not associated with a venom gland or advanced secretory gland. Colubrid species with fangs or enlarged teeth that have open-lumen channels or grooves and are located in the posterior maxillary portion jaw are opisthoglyphus. These may be semi-venomous (ie. *Malpolon monspessulanus*, Montpellier or Yaleh snake - Iran), and a very few are venomous (ie. *Dispholidustypus*, boom slang - Africa) species. These species are frequently referred to as *rear-fanged* or non-front-fanged snakes (10). The teeth may also be loosely associated with secretory or Duvernoy's glands. Semi-venomous colubrid snakes and non-venomous colubrid snakes, as well as elapid species (ie. *Walterinnesiaaegyptia*, desert cobra or desert black snake) may appear very similar based on their external gross anatomy. They generally have round eye pupils, large plate scales on the head that are significantly different scales on the body, and they do not have a pronounced appearing differentiation between their head and neck. In contrast, venomous viper snakes generally will have vertically elliptical pupils, and the scales on the head are typically small and irregular appearing. Body scalation is also different depending on the species. Some snake have smooth scales on the dorsal body, while other species have dorsal body scales that are bladed with a prominent line or keel in middle portion of the scale. Ventral scales in general are transverse, larger, and smoother than dorsal scales. Venomous, semi-venomous, and non-venomous snakes may potentially bite any attacker or predator, aimed at defending itself. This may cause pain to the bitten site on the body as a result of trauma from the teeth, and envenomation with semi-venomous or venomous snakebites. Additionally, there is the potential for localized or generalized infection to develop following the bite by any species (11, 12). Snakebites to humans have been considered a medical problem in Iran for hundreds of years, historically ranging from approximately 5609 to 5172cases during the 7 years from 2002 to 2009. During the same years, registered deaths were reported to have been 4 to 12 cases each year (13, 14). In each geographic region, given the diversity of climate and species of snakes, bites by a given species may result in a wide range of local and systemic signs and symptoms may be anticipated after a bite to humans (15). In addition to the pain and localized or systemic infection that may be associated with snake bites, envenomation can result in shock, acute kidney injury, coagulation disorders, vascular damage and cardiomyopathy maybe consequently occur in some cases (6). Common complications following snake envenomation often occur due to hemorrhagic or neurotoxic effects, which may be associated with secondary infection. However, another important point is that the bite of non-venomous snakes also may cause bacterial infection (16). Abscess is the most common manifestation of infection due to snakebite, and in a few instances has been suspected as one of causes of death (17, 18). Like other animals, various types of bacteria might be recovered from infected snakebite wounds, which are most often a reflection of the oral flora of the biting snake; although ingested prey and other food may influence the type of bacteria introduced with the bite. A variety of pathogenic bacteria have been identified in cultures of venom and saliva of snake oral cavities (19). Given that snakebite is a significant medical problem in Iran, and often associated with complications ranging from envenomation from venomous snake species to potential infectious complications following bites from non-venomous snakes, there is special importance in being able to distinguish between venomous and non-venomous snakes. This study was conducted and aimed at identifying different species of non-venomous snakes in Kashan, located in the center of Iran.

2. MATERIALS AND METHODS

2.1. Study Area and Design

2.1.1. Study area

Kashan is located within Central Mountains in Southern and Western of Iran, and lies in the north of the Esfahan Province. Kashan city is divided into two geographic

regions: the plains and mountainous terrains. Kashan is expansive, ranging in longitude from $50^{0}57$'to $51^{0}51$' in the East, to latitude of $27^{0}33$' to $28^{0}34$'in the north, and covers an area of 10,000 square kilometers. Kashan is located in a low altitude area and surrounding villages generally have a mild climate and are connected to mountainous areas. There are also areas that are connected to salt marshlands, and in the central desert, the weather is dry and hot, such as it is present in the flat land of the city. The main reason for dry air in Kashan is that it is adjacent to the Kavir desert (Dasht-E-Kavir), and is part of the dry region of the Iranian plateau located in the central desert.

2.1.2. Study Design

The study is a cross-sectional design, and the study population was the snakes that were collected in the city of Kashan, and its suburbs over a three-year period from 2010 - 2012.

2.2. Snakes collecting cite

Kashan, Ravand, Meshkan, Aran and Bidgol, Niasar and Abbas abad desert in Esfahan province

2.3. Collected and caught snakes

Hemorrhois ravergieri, *Spalerosophis microlepis*, *Platycep rhodorachis*, *Natrix tessellate*, *Rhynchocalamus melanocephalus* and *Eryx miliaris.*

All specimens collected (live or dead) were documented with the specific date collected, and the location of collection. Living specimens were collected from urban areas of Kashan, and its suburbs, were housed separately, fed a diet of live mice, and provided water ad lib to maintain their health. This allowed for the study of their biological characteristics. Non-living specimens collected were preserved in ethanol. Identification of species was based on morphological characteristics using taxonomic identification keys. All specimens were classified as semi-venomous, or non-venomous. Thereafter, identified specimens were compared with detailed information of the related sources. As a descriptive study,The obtained information was fed on Microsoft excel in computer package and statistically analyzed via SPSS version 10.0; applied statistical tests were chi-square test and, percentage wherever applicable. This study was approved by the Medical Ethics Committee, No.9110, (animal health committee). After the study all live snakes were returned to natural habitats of them.

3. RESULTS AND DISCUSSION

A total of 41 snakes were collected, examined, and classified to family, genus, and species in the laboratory. Of the total specimens collected there were: 32 (78%) Reverie's racer (*Hemorrhois ravergieri*), 3 (7%) zebra snakes **(***Spalerosophis microlepis***)**, 3 (7%) Braid Snakes **(***Platycep rhodorachis*), 1 (2%) Dice Snake **(***Natrix tessellate*), 1 (2%) Black-headed Snake (*Rhynchocalamus melanocephalus*), and 1(2%) Desert Sand Boa (*Eryx miliaris*) taxonomically identified (Table 1).

Table 1. Prevalence of non-venomous snakes (aglyphus snakes), site of capture, common name, Family, and scientific name found in the region of Kashan city in terms of region of hunting and family

Scientific name	*Family*	*Name*	*Hunting location*	*Number (%)*
Hemorrhois (Coluber) ravergieri	Colubridae	Ravergier`s racer	Kashan, Ravand, Meshkan, Aran and Bidgol	**32 (78)**
Spalerosophismicrolepis	Colubridae	Zebra Snake	Niasar	**3 (7.4)**
Platyceps (Coluber) rhodorachis	Colubridae	Braid Snake	Niasar	**3 (7.4)**
Natrixtessellata	Colubridae	Dice Snake	Niasar	**1 (2.4)**
Rhynchocalamus melanocephalus	Colubridae	Black-headed Snake	Niasar	**1 (2.4)**
Eryx miliaris	Boidae	Desert Sand Boa	Abbas abad desert	**1 (2.4)**
				41

Assignment of collected species to family resulted in 97.5 % of the species belonging to the Colubridae family and 2.5% to Boidae family (Table 1). Specimens from two different species collected, *Hemorrhoisrevergieri* and *Spalerosophismicrolepis,* provided were gravid and provided eggs (Figure 3, Figure 5).

3.1. Morphological and Descriptive Characteristics of the Colubrid Species Studied

3.1.1. Ravergier`s racer (Hemorrhois (Coluber) ravergieri)

Head: This snake has a prominent snout and neck. The anterior side of the frontal scale is wider than the supra-ocular scale and shorter than the parietal scale**.**Inter-nasal scales are equal to, or slightly shorter than, the pre-frontal scales. There are two pre-ocular scales and one sub-ocular scale, and the upper part of pre-ocular scale is attached to the frontal scale. There are two post-ocular scales, and the temporal scales are very small. There are 9 or 10 supra-labial scales and 9 to 11 infra-labial scales, while the length of posterior genial scales is equal to the anterior genials, the width of the posterior genial scales is less than

the width of the anterior genials, and these two are separated by 2 or 3 rows of scales. Dentition – The snake's mouth teeth are simple and it is not fangs Body - The dorsal surface is comprised of 21 dorsal scales that are prominent and bladed/keeled, and the ventral surface is comprised of 192 to 226 transverse ventral scales that are angular on the lateral side; toward the tail there are 62 to 105 sub-caudal and anal scales. Maximum body length from the tip of the snout to the tip of the tail is 159 cm (Figure 1, Figure 2).

Figure 1. Ravergier`s racer (Hemorrhois (Coluber) ravergieri) – live specimen (Photo by R. Dehghani)

Figure 2. Ravergier`s racer (Hemorrhois (Coluber) ravergieri) – live specimen (Photo by R. Dehghani)

Color and Pattern: The body color may be buff, gray to light brown, olive brown or yellow, or gray brown, patterned with varied different lines and designs. The dorsal surface has dark lines (sometimes in the form of a square) alternating with black spots. Three continuous longitudinal dark lines are seen at the tail; a diagonal dark line extends from the lateral side of the head to the corners of the mouth, and another dark line is present under the eyes. The ventral surface is light often with small spots. Occasionally, the snake's head or body is black entirely, and in some instances there is a more regular pattern of dark lines that may sometimes appear irregular and brighter. The species is sexually dimorphic, and the patterns of lines and designs are different between the two sexes; females have large black spots dorsally, in comparison with males, which are uniform and without pattern or designs. Reproduction: *H.ravergieri* is oviparous. Summer (more in July to August) is the season of laying eggs, which are larger than a hazelnut; their number reaches 11 to 12eggs per clutch. The eggs measured 6 cm in length 2 cm in width Egg has a cylindrical shape. Each egg weighs is about 13-16 grams (Figure 3).

Figure 3. Ravergier`s racer eggs (Photo by R. Dehghani)

3.1.2. Zebra snake (Spalerosophis microlepis)

Head - This snake has a prominent snout, and the height of rostral scale is greater than its width. The dorsal surface of the snout has many small scales, and the temporal and maxillary areas are covered by multiple small scales. Frontal scales are divided into three sections: 13 to 16 supra-labial scales and 12 to 15 infra-labial scales, with 11 to 15 scales around the eyes. The upper lip is separated from the eye by a row of scales. Six infra-labial scales are attached to the anterior chin-shield scales. Dentition – The snake's mouth teeth are simple and it is not fangs. Body - Dorsal fold scales are small and are separated from each other by two rows of scales. There are 41-43 dorsal scales that are smooth surfaced; 224 to 252 ventral scales, and there are 90-109 sub-caudal scales. There is a single anal-plate scale. It can potentially reach a maximum length of 143 cm (Figure 4).

Figure 4. Zebra snake (*Spalerosophismicrolepis*) specimen live (Photo by R. Dehghani)

Color and Pattern - The snake's dorsal body is light brownish gray colored. Polygonal black spots are present on the anterior part of the body, with black dark continuous lines on both sides of the neck from the nose and eyes to the corners of the mouth. The ventral surface is light yellow. Reproduction – The species is oviparous, and the extracted eggs measured 2.3 cm in length 1.7 cm in width Egg has a cylindrical shape. Each egg weighs about 5-7 grams (Figure 5).

Figure 5. Zebra snake eggs (Photo by R. Dehghani)

3.1.3. Black-headed snake (Rhynchocalamus melanocephalus)

Body - The black-headed ground snake is a small, with a slender body. It is smooth and shiny, dorsal scales and almost transparent covering make many of its internal organs quite visible, when observed against a light source. In our study maximum length reached is 41 cm. This snake was captured at Niasar (Figure 6).

Figure 6. Blackhead snake (*Rynchocalamusmelanocephalus*) – dead specimen (photo by R. Dehghani)

Head - The black-headed snake has a single nose scale; the groove between inter nasal scales is equal to the groove between prefrontal scales. The length of frontal scale is nearly equal to its distance to the snout and a little shorter than parietal scales. Four small square maxillary scales may or may not be present. Dentition – The snake's mouth teeth are simple and it is not fangs. Color and Pattern - The dorsal body color may be yellow, olive red, brownish- dark orange and the dorsal part of the head and neck are dark blue or black; the color of the ventral surface is light yellow to white. Reproduction – we have not any record about life cycle.

3.1.4. Braid snake (Platyceps (Coluber) rhodorachis)

Head-The snout is relatively sharp; the width of rostral scale is greater than its height. Widths of inter-nasal scales are equal to or less than prefrontal scales, and the anterior side of the frontal scale is wider than supra-ocular scales. The pre-ocular scale is often attached to the frontal scale. On the lower side of the eye there is an infra-ocular scale, and there are two post-ocular scales behind the eye. The numbers of temporal scales were 3 +2 (rarely 2 +2). There are 9 supra labial scales (fifth and sixth scales are attached to the eye). Four or five infra-labial scales are attached to the anterior chin-shield scale. Scales of the posterior chin-shield are equal to or slightly longer than the anterior portion, and are separated by two rows of scales. Dentition

– The snake's mouth teeth are simple and it is not fangs. Body – This is an elongated and slender bodied snake. There are 19 dorsal scales that are smooth surfaced (no keel or ridge-blade). The ventral surface scales number 214 to 235, and the numbers of sub-caudal scales are 106 to 136.The length is up to 129 cm. Color and Pattern – The body color may be olive, light grayish, brownish olive, and it may be uniform in color or with different designs and lines. In some specimens, a brownish or orange colored line runs longitudinally from head to tail following the line of the vertebral column on the back. Occasionally, there is no line is on the dorsal surface, and the color of the anterior and posterior part of the body is different. On the upper portion of the dorsal body surface, there are irregular dark or black zigzag lines with smaller spots present on the lateral surface. The dorsal posterior part of the body is uniform gray or olive-colored (Figure 7, Figure 8).

Figure 7. Braid snake (*Platycepsrhodorachis*) – live specimen (Photo by R. Dehghani)

Figure 8. Braid snake with (*Platycepsrhodorachis*) dorsal red stripe (Photo by R. Dehghani)

3.1.5. Dice snake (Natrixtessellate)

Head - This snake has a sharply defined neck and slightly narrow snout, eyes with round pupils, and more or less triangular inter-nasal scales. The groove between rostral

scales and the first supra-labial scale is longer than the groove between rostral scales and inter-nasal scale. There may be one or sometimes two or three pre -ocular scales, and three or four and sometimes five post-ocular scales as well. The upper lip and lower lip have 8 scales and 9 scales, respectively. The number of temporal scales is 1+2, sub-caudal scales are completely continuous. Dentition – The snake's mouth teeth are simple and it is not fangs. Body - Two connected dark lines are usually present on the back of the head (Figure 9, Figure 10).

Figure 9. Dice snake (*Natrix tessellate*) dorsal surface – live specimen (Photo by R. Dehghani)

Figure 10. Dice snake (*Natrix tessellate*) ventral surface (Photo by R. Dehghani)

Ventral surface color is reddish yellow with quadrilateral black spots. The presence of 19 spots is prominent in some snakes. The number of ventral scales ranges from 167 to 184, and anal scale is divided. The body scales are heavily keeled. Maximum length of this snake is 103 cm. Color and Pattern - The dorsal body color is usually olive, gray-olive, light green or brown with irregular spots; sometimes black. Reproduction – This species is oviparous and lay eggs in late summer.

3.1.6. Desert Sand Boa (Eryxmiliaris)

Head-**T**his snake has a slightly raised snout, and its eyes are tilted upward. It has four scales on the back of the inter-nasal scales. The distance between the two eyes is less than the distance from the corners of the mouth to the posterior part of the eye. There are 6 to 9 scales between the two eyes and 10 to 14 scales around the eye. There are 10 to 14 supra-ocular scales and the third scale is shorter than the second. The maximum body length is 65 cm. Dentition – The snake's mouth teeth are simple and it is not fangs. Body - Dorsal and tail scales are flat or slightly prominent; the number of dorsal scales is 45 to 52, ventral surface 174 to 202, and the number of sub caudal scales is 21 to 32. Color and Pattern - The color of dorsal body is brown with brown spots with clear margins. In some instances the spots are regular zigzag and in some others they may be irregular. Spots are more detectable in the anterior part of the body than the posterior part. Some spots have black margins. The lateral surface of the body is light and some scales have a dark brown or black margin (Figure 11).

Figure 11. Desert land boa (*Eryxmiliaris*)

Reproduction – we do not any record about their life cycle. The snakes were collected in the desert sandy lands of Abbasabad Aran and Bidgol. A Picture was not taken by the author due to the extreme variable color morphological

forms of this snake. At least six species of Aglyphus snakes belonging to two families, Colubridae and Boidae, exist in the city of Kashan based on the results of this study. One way to classify snakes to family is based on an assessment of the snake's dentition; Snakes are divided to three main groups based on dentition: non-venomous, semi- venomous and venomous in this sense. On-venomous snakes' teeth are simple with no duct or venom secretory gland or venom gland present. Semi-venomous snakes (rear-fanged or non-front-fanged snakes) have fangs or enlarged, grooved posterior teeth in the rear maxillary portion of the mouth that are anatomically close to a secretory gland which can elaborate toxic saliva onto the grooved teeth (7, 9, 10, 12). The fangs of venomous snakes are located in the front of the mouth in the upper frontal maxillary region. The fangs are hollow with a lumen and connect to a venom duct that connects to a defined venom gland. When examining the teeth of a snake there is risk of being bitten, and although the species described here are non-venomous, there is the potential risk of infection in addition to the trauma from the bite. As such, caution should be taken when handling these snake species for identification. Considering these multiple different morphological characteristics, results of investigations have shown that diverse climates in different parts of the mountains and plains support a richly diverse snake fauna in kashan city (7, 9, 10, 12). Based on our findings, these six non-venomous species of snakes have been documented in Kashan city and its suburbs. This is the first time that a specific study has been carried out in this region although previous researches have reported the appearance of multiple snake species in all parts of Iran. This region of the country has been provided a wide range of precise studies concerning the biological and behavioral aspects of venomous animals yet there is a substantial need for investigations in other geographic areas of the country (20). In this study, Ravergier`s racer snake represented the highest number of the captured snakes (78%). Ravergier`s racer snake has not been considered as a venomous snake, but its bite has resulted in blue discoloration and edema in a bitten extremity (11). Additionally, based on morphological key points which were previously mentioned, its bite may potentially lead to infection because of bacterial contamination of the saliva. This species has been found in various regions of the country and has been previously reported by researchers such as Latif (2000), FarzanPey. (1990) from all parts of the country (province of Khorasan, Markazi, Tehran, East and West Azerbaijan, Ardabil, Zanjan, Mazandaran, Fars, Kermanshah, Hamedan, Sistan and Baluchestan, Semnan, Kurdistan, Khuzestan, Isfahan, Lorestan, Gilan, Qazvin, Kerman, Qom (7, 9-12). Fathinia and colleagues (2010) reported *Spalerosophis microlepis* in Ilam and from the West of the country which is consistent with the results of our study (20). The zebra snake collected was second most common in this study. This snake is native to Iran and there are no reports of it from elsewhere in the world so far. In Iran, It has been reported in several different provinces such as Fars, Markazi, Hamadan, Khuzestan, Isfahan, Lorestan, Qom and Chahar Mahal and Bakhtiari. Reports of bites by this species are lacking and there is a need for documentation of cases when they occur. *Platyceps rhodoracis* was also the second most common species collected in the current study. Little is known about the consequences of bites by this species. However, there is a report of lymphadenopathy having resulted from the bite of *P. rhodoracis* (11). Four other species such as desert sand boa, black-headed snake, dice snake and the braid snake have also been reported from other regions of the Iran (7, 10-12). Distinguishing between a venomous and non-venomous bite is an important concern and subject in the medical management of snake bites and as experiences on specifications of bites by native snakes rise, management protocols are updating over time (21). Although envenomation is usually a specific complication associated with venomous snakes, adverse reactions to bites by non-venomous species can occur, which may be further complicated by bacterial infections. Therefore, bites by non-venomous snakes are a potential major complication with respect to infection, and with venomous snakebites this concern is in addition to the consequences of envenomation. The first author of the current study, and colleagues, carried out a separate study on oral flora of 11 snakes during 6 months in Kashan city. Samples from the11 snakes included 9 from non-venomous specimens and 2 from venomous specimens. The most frequently observed bacteria were *staphylococcus* coagulase-negative (34.5%), followed by *salmonella* (18.8%), *Escherichia coli* and *providencia* with 12.5%,*proteus*, *enterococcus* and *bacillus* with 6.5% for each of them, and finally *pseudomonas* with 3.1% (Dehghani et al 2012b).A mixture of different bacterial species including aerobic and anaerobic have been revealed in other studies of oral bacterial flora of snakes and their venom (21-23). Some studies have suggested that fecal flora of ingested prey might influence on isolated oral flora of snake (21). Investigations on infected wounds of snake bite patients have revealed polymicrobial infections (24, 25). Jorge et al. reported 40 patients with abscesses at the bite site of *Bothrops*spp., and *Morganella morganii* was the most frequently (23 patients) identified organism (24). In a retrospective study conducted by Garge et al., it was reported that of 43 wound infections secondary to snake bite, 56% presented with a subcutaneous abscess, and the rest had localized tissue necrosis (26).

4. CONCLUSION

Considering the subject of snakebite in Kashan city and its suburbs, and the fact that most bites occur in warm seasons when people are active outside, it is reasonable to not only develop appropriate preventive measures with respect to reducing the incidence of snakebites, particularly in cases involving children and the elderly, but also increase awareness among healthcare professionals of the potential

risk for infection following the bite of non-venomous snakes. Although the main medical problem is related to venomous snakes, non-venomous snakes also have special importance in terms of potential infections which may be transferred to the patient via contaminated saliva of snake. By acquiring basic information about the different species of snakes in each geographical region, it would be possible to develop a proper framework for improving correct medical management.

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CONFLICT OF INTEREST

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REFERENCES

1. Rastegar-Pouyani N, Faizi H, Oraei H, Khosravani A, Fathinia B, Heidari N, et al. A brief his. 2011.
2. Trape J-F, Pison G, Guyavarch E, Mane Y. High mortality from snakebite in south-eastern Senegal. Transactions of the Royal Society of Tropical Medicine and Hygiene. 2001;95(4):420-3.
3. Bawaskar H, Bawaskar P. Profile of snakebite envenoming in western Maharashtra, India. Transactions of the Royal Society of Tropical Medicine and Hygiene. 2002;96(1):79-84.
4. Shah MH. The general principles of Avicenna's Canon of medicine: Naveed Clinic; 1966.
5. Dehghani R. Environmental toxicology. Kashan University of Medical Science and Takderakht Publisher, Kashan. 2010.
6. Dehghani R, Rabani D, Shahi MP, Jazayeri M, Bidgoli MS. Incidence of Snake Bites in Kashan, Iran During an Eight Year Period (2004-2011). Archives of trauma research. 2012;1(2):67.
7. Latifi M, Leviton AE, Sajadian S, Zug GR. The snakes of Iran: Society for the Study of Amphibians and Reptiles; 1991.
8. Rastegar-Pouyani N, Kami HG, Rajabzadeh M, Shafeie S, Anderson SC. Annotated checklist of amphibians and reptiles of Iran. Iranian Journal of Animal Biosystematics. 2008;4(1):7-30.
9. Moradi N, Shafiei S, Sehhatisabet M. The snake fauna of Khabr National Park, southeast of Iran. Iranian Journal of Animal Biosystematics. 2013;9(1).
10. Weinstein SA, White J, Keyler DE, Warrell DA. Non-front-fanged colubroid snakes: a current evidence-based analysis of medical significance. Toxicon. 2013;69:103-13.
11. Weinstein SA, Warrell DA, White J, Keyler DE. "Venomous Bites from Non-Venomous Snakes: A Critical Analysis of Risk and Management of "Colubrid Snake Bites: Elsevier; 2011.
12. Gholamifard A. Endemism in the reptile fauna of Iran. Iranian Journal of Animal Biosystematics. 2011;7(1).
13. Dehghani R, Dadpour B, Mehrpour O. Epidemiological Profile of Snakebite in Iran, 2009-2010 Based on Information of Ministry of Health and Medical Education. International Journal of Medical Toxicology and Forensic Medicine. 2014;4(2 (Spring)):33-41.
14. Dehghani R, Fathi B, Shahi MP, Jazayeri M. Ten years of snakebites in Iran. Toxicon. 2014.
15. Besharat M, Abbasi F. Snakebite in Iran: diagnosis, treatment and prevention. Journal of Medical Council of Islamic Republic of Iran. 2009;27(1):Pe63-Pe72, En147.
16. Huang L-W, Wang J-D, Huang J-A, Hu S-Y, Wang L-M, Tsan Y-T. Wound infections secondary to snakebite in central Taiwan. Journal of Venomous Animals and Toxins including Tropical Diseases. 2012;18(3):272-6.
17. Jorge M, Malaque C, Ribeiro L, Fan H, Cardoso J, Nishioka S, et al. Failure of chloramphenicol prophylaxis to reduce the frequency of abscess formation as a complication of envenoming by Bothrops snakes in Brazil: a double-blind randomized controlled trial. Transactions of the Royal Society of Tropical Medicine and Hygiene. 2004;98(9):529-34.
18. Fonseca M, Moreira W, Cunha K, Ribeiro A, Almeida M. Oral microbiota of Brazilian captive snakes. Journal of Venomous Animals and Toxins including Tropical Diseases. 2009;15(1):54-60.
19. Theakston R, Phillips R, Looareesuwan S, Echeverria P, Makin T, Warrell D. Bacteriological studies of the venom and mouth cavities of wild Malayan pit vipers (Calloselasma rhodostoma) in southern Thailand. Transactions of the Royal Society of Tropical Medicine and Hygiene. 1990;84(6):875.
20. Fathinia B, Rastegar-Pouyani N, Darvishnia H, Rajabizadeh M. The snake fauna of Ilam Province, southwestern Iran. Iranian Journal of Animal Biosystematics (IJAB). 2010;6(1):9-23.
21. Goldstein EJ, Citron DM, Gonzalez H, Russell FE, Finegold SM. Bacteriology of rattlesnake venom and implications for therapy. Journal of Infectious Diseases. 1979;140(5):818-21.
22. Shek K, Tsui K, Lam K, Crow P, Ng K, Ades G, et al. Oral bacterial flora of the Chinese cobra (Naja atra) and bamboo pit viper (Trimeresurus albolabris) in Hong Kong SAR, China. Hong Kong Med J. 2009;15(3):183-90.
23. Theakston R, Phillips R, Looareesuwan S, Echeverria P, Makin T, Warrell D. Bacteriological studies of the venom and mouth cavities of wild Malayan pit vipers (Calloselasma rhodostoma) in southern Thailand. Transactions of the Royal Society of Tropical Medicine and Hygiene. 1990;84(6):875-9.
24. Jorge MT, Ribeiro LA, Da Silva MLR, Kusano EJ, de Mendonça JS. Microbiological studies of abscesses complicating< i> Bothrops</i> snakebite in humans: A prospective study. Toxicon. 1994;32(6):743-8.
25. Kerrigan KR. Bacteriology of snakebite abscess. Tropical doctor. 1992;22(4):158-60.
26. Garg A, Sujatha S, Garg J, Acharya NS, Parija SC. Wound infections secondary to snakebite. The Journal of Infection in Developing Countries. 2009;3(03):221-3.