



Epidemiologic - Demographic Status of Scorpion- Stung Patients in Khorramshahr County, Southwestern Iran

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ABSTRACT

Introduction and Objectives: Nearly two-thousand scorpion species have been identified worldwide, twenty-five of which have health importance. Each year approximately half a million individuals are stung by scorpions in the world with a fatality rate of 3250 people. In Iran, there are nearly 40000 cases in a year and the numbers of recorded deaths are between 14-29 people. Scorpionism is one of the most significant medical subjects in Iran especially in the southern areas; so that Khuzestan Province is one of the most significant foci of scorpionism. Therefore, the present study aimed to determine the epidemiological characteristics of the individuals stung by scorpions in Khorramshahr region, Khuzestan province, Southwestern Iran. **Materials and Methods:** In this analytic descriptive study, all patients with scorpion sting were assessed from 2013 to 2017. Data regarding the patient's age, gender, site of the sting, month of envenomation, administration of scorpion antivenin, time of the sting, geographical area, and the color of scorpion were extracted and recorded. Data were analyzed by using SPSS software, version 22.0 using Pearson's Chi-square and student's t-test. A p-value of less than 0.05 was considered statistically significant. **Results:** During the research period, the total number of scorpion stings reviewed was 1045. Envenomation with scorpions was reported throughout the year. About 42.7% and 31.1% of the stings occurred during summer and spring, respectively, most of which occurred in June (%20.5) and July (%18.6). The most prevalent site of envenomation was the lower extremities (62.5%), followed by upper extremities (36.9%) and trunk (0.6%). The gender distribution showed 44.5% females and 55.5% males. In addition, more than 48.8% of patients referred to the hospital at night between 18:00 to 00:00. In 58.5% of the stung patients, the color of the scorpions was black. The majority of patients aged more than 50 (20.8%) and 0-10 (19.1%) years. There were significant statistical differences between these variables and the prevalence of stings. **Conclusions:** The presence of medically important scorpions, in Khuzestan Province, requires control and health educational programs for the reduction of scorpion sting problem.

Keywords: Scorpionism, Epidemiology, Demography, Scorpion, Prevalence, Iran

HOW TO CITE THIS ARTICLE: Hamid Kassiri, Iman Khodkar, Shahnaz Kazemi, Niusha Kasiri, Maral Kassiri; Epidemiologic - Demographic Status of Scorpion- Stung Patients in Khorramshahr County, Southwestern Iran), Entomol Appl Sci Lett, 2019, 6 (3): 73-81.

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Received: 02/04/2019

Accepted: 23/09/2019

INTRODUCTION AND OBJECTIVES

Scorpions are dangerous arthropods subsisting from the late Silurian about 330 million years ago [1]. They are carnivores and eat insects, worms, arthropods, lizards and even baby ro-

dents. Scorpions are nocturnal animals and leave their nests at night to hunt. People are accidentally stung by scorpions. Scorpions accidentally hide in clothing or shoes and sting people when they wear them [2]. This imposes relatively heavy economic costs and mental-emotional burdens on society [3].

Factors such as age and weight of the stung person, the location of the sting on the body, the time of the sting, and scorpion species affect the severity of toxication and the onset of symptoms. Symptoms are more severe in the elderly and children [4]. Symptoms of scorpion sting include agitation, trouble walking, dysarthria, drooling, allodynia, muscle twitching or thrashing, abdominal pain, breathing problems, rapid pulse, hypertension, rapid breathing, cold sweat, urinary retention, dilated pupils, horripilation, pale face, salivation, runny nose, and tearing. Gastrointestinal symptoms also include nausea, vomiting, abdominal pain, and diarrhea [5, 6]. Scorpion sting is considered a major health problem in African and Middle Eastern countries such as Algeria, Egypt, Iraq, Jordan, Morocco, Sudan, South Africa, and Turkey, and in the South and North American countries such as Brazil, Mexico, Trinidad and Tobago, Argentina, and Venezuela [3, 7, 8].

Due to its climatic conditions, Iran has a variety of insects and arthropods that can cause diseases or intoxication. Iran is also ranked second in the world after Mexico with around 250000 bites and stings per year. Scorpion stings account for 42 to 45 thousand poisoning cases that occur annually in Iran. Most cases of scorpion stings and most deaths from them in Iran occur in Khuzestan Province (Southwestern Iran). Scorpion stings are reported from all Iranian provinces, but Hormozgan, Sistan-Baluchestan, Bushehr, Fars, and Kerman have the highest rates of scorpion stings after Khuzestan. The lowest number of scorpion sting cases is reported from the northern provinces of the country and from Tehran [9, 10].

Khorramshahr, a county with a population of about 170000 in Khuzestan Province in southwestern Iran, has a special situation with respect to snake bites and scorpion stings compared to other parts of the country because of geographical, cultural, and socio-economic factors. Considering the high incidence of scorpion stings in this county, it seems that epidemiological investigations and their analysis can provide some strategies for the prevention of scorpion stings, their resulting mortality, and their timely treatment.

MATERIALS AND METHODS

Khorramshahr (30°26'23"N 48°09'59"E) is an inland port city, situated in the southwest of Iran and has a desert climate. It is situated at elevation 4 meters above sea level. There is virtually no rainfall during the year. In Khorramshahr, the average annual temperature is 24.9 °C. Precipitation here averages 181 mm. The driest month is June when there is 0 mm of precipitation. The greatest amount of precipitation occurs in January, with an average of 39 mm. With an average of 35.5 °C, August is the warmest month. The lowest average temperatures in the year occur in January when it is around 12.1°C. The precipitation varies 39 mm between the driest month and the wettest month. The variation in temperatures throughout the year is 23.4 °C. Its population was about 170976 in the 2016 census.

This cross-sectional descriptive-analytical study was conducted from 2013 to 2017. The study was approved on 13/3/2019 by the Committee of Ethics in Research, Ahvaz Jundishapur University of Medical Sciences and registered as IR.AJUMS.REC.1398.043. Participation was fully voluntary and informed written consent was obtained from directors and each study participant. All victims received the antivenin. The data were recorded in a questionnaire using interviews. The population included all patients whose scorpion sting was confirmed through interviews and clinical trials. Epidemiological data collected by means of research-made questionnaires about patients were analyzed with SPSS software version 18. This tool included information on the following basis: gender, age, geographical area, color of the scorpion, sting site on the body, administration of scorpion antivenin, time of being stung, month and season. Data were analyzed by using SPSS software, version 22.0 using Pearson's Chi-square, and student's t-test. A p-value of less than 0.05 was considered statistically significant.

RESULTS:

During 2013-2017, there were 1045 reported cases of scorpion stings from Khorramshahr. Given the average population of 170000 people in this county, the estimated mean incidence rate for these 5 years was 1.22 per thousand people. The highest incidence rate happened in 2014 with 258 reported cases of scorpion stings.

Men were more commonly stung by scorpions than women: they accounted for 580 cases (55.5% of the total) and women for 465 cases (44.5% of the total). The results of the t-test showed a significant difference between men and women in the incidence rate of scorpion stings (Table 1).

Most cases of scorpion stings occurred at the age group above 50 with 217 cases (20.8% of the total) followed by the age group below 10 with 200 cases (19.1% of the total). The lowest number of cases was observed at the age group 41-50 with 127 cases (12.1% of the total) during these 5 years. The nonparametric chi-square test showed that there were no significant differences between the age groups in the number of scorpion sting cases (Table 1).

According to the geographical distribution of scorpion stings cases, the majority of stings occurred among urban residents with 640 cases (61.2% of the total) and 405 cases (38.8% of the total) happened among rural dwellers. The results of the paired t-test revealed that there was no significant difference between urban and rural dwellers in the incidence of scorpion sting cases (Table 1).

The highest number of scorpion sting cases (510 cases or 48.8% of the total) occurred between 18-24 o'clock, and between 00-6 (304 cases or 29.1% of the total) and the lowest number (101 cases or 9.7% of the total) between 12-18. The use of the nonparametric chi-square test showed that there was a statistically significant difference between these hours of the day and night with respect to scorpion sting cases (Table 1).

Most and least of scorpion sting cases occurred in June with 214 cases (20.5% of the total) and in January with 9 cases (0.9% of the total), respectively (Table 1 and Figure 1). Seasonal distribution of scorpion sting cases also indicated that 367 cases (34.1% of the total) occurred in spring, 446 cases (42.7% of the total) in summer, 170 cases (16.3% of the total) in the fall

and 62 cases (5.9% of the total) in winter (Figure 2). There was a significant difference between the months of the year in the number of scorpion sting cases according to the nonparametric chi-square test.

In terms of anatomical sting locations, 653 cases (62.5% of the total) were on the legs, 386 cases (36.9% of the total) on the hands and 6 cases (0.6% of the total) on the trunks. The use of the nonparametric chi-square test demonstrated that there were significant differences between these anatomical locations in scorpion sting cases (Table 1).

The time interval between the scorpion sting and the visit to a hospital is one of the most important variables to consider. Of the 1045 scorpion sting cases, in 948 cases (90.7% of the total) the victims were taken to hospital within one to four hours and in 54 cases (5.2% of the total) more than four hours after they were stung. There was a significant difference among the time intervals between being stung and being taken to the hospital according to the nonparametric chi-square test (Table 1).

According to the color of the scorpions, 614 cases (58.5% of the total) were stung by black scorpions and 434 cases (31.5% of the total) by yellow ones. The paired t-test indicated that there was a significant difference between the color of scorpions and the number of scorpion sting cases (Table 1).

Table 1: The frequency distribution of scorpion sting cases based on age, gender, scorpion color, residential area, site of sting on the body, interval time between sting and arriving the hospital, and sting clock and month, in Khorramshahr County, Khuzestan Province, Southwestern Iran during 2013-2017.

| Variable / Year | | 2013 No (%) | 2014 No (%) | 2015 No (%) | 2016 No (%) | 2017 No (%) | Total No (%) | P Values |
|---|-----------|------------------|-----------------|------------------|------------------|------------------|------------------|-------------|
| Age group | 0-10 | 47(23.6) | 51(19.8) | 37(19.0) | 31(15.3) | 34(17.8) | 200(19.1) | < 0.08 |
| | 11-20 | 35(17.6) | 39(15.1) | 28(14.4) | 30(14.8) | 33(17.2) | 165(15.8) | |
| | 21-30 | 33(16.6) | 42(16.3) | 30(15.4) | 34(16.8) | 36(18.8) | 175(16.7) | |
| | 31-40 | 22(11.0) | 38(14.7) | 36(18.5) | 41(20.2) | 24(12.6) | 161(15.4) | |
| | 41-50 | 28(14.1) | 35(13.6) | 18(9.2) | 16(7.9) | 30(15.7) | 127(12.1) | |
| | >50 | 34(17.1) | 53(20.5) | 46 (23.6) | 50 (24.7) | 34 (17.8) | 217 (20.8) | |
| Gender | Female | 77(38.7) | 91(35.2) | 79(40.5) | 123(60.9) | 95(49.7) | 465(44.5) | <0.05 |
| | Male | 122(61.3) | 167(64.8) | 116(59.5) | 79(39.1) | 96 (50.3) | 580(55.5) | |
| Scorpion body color | Yellow | 85(42.7) | 102(39.5) | 79(40.5) | 97(48.0) | 68 (35.6) | 431(41.5) | <0.001 |
| | Black | 114(57.3) | 156(60.0) | 116(49.5) | 105(52.0) | 123(64.4) | 614 (58.5) | |
| Residential area | Urban | 148(63.4) | 168(65.1) | 123(63.1) | 105(52.0) | 96 (50.2) | 640(61.2) | <0.09 |
| | Rural | 51(36.6) | 90(34.9) | 72(36.9) | 97(48.0) | 95 (49.8) | 405(38.8) | |
| Site of sting on the body | Hand | 66(33.2) | 98(38.0) | 75(38.5) | 58(28.7) | 89 (46.6) | 386(36.9) | <0.05 |
| | Leg | 132(66.3) | 158(61.2) | 120(61.5) | 141(69.8) | 102 (53.4) | 653(62.5) | |
| | Trunk | 1(0.5) | 2(0.8) | 0 (0.0) | 3 (1.5) | 0 (0.0) | 6 (0.6) | |
| Interval time between sting and reaching the hospital (hours) | <1 | 6(3.0) | 14 (5.4) | 5(2.5) | 9(4.4) | 9 (4.7) | 43 (4.1) | <0.001 |
| | 1-4 | 185 (93.0) | 233 (90.3) | 162 (83.1) | 191 (94.6) | 177 (92.7) | 948 (90.7) | |
| | 5-8 | 6 (3.0) | 9 (3.5) | 21 (10.8) | 2 (1.0) | 5(2.6) | 43 (4.1) | |
| | 9-11 | 2 (1.0) | 2 (0.8) | 5 (2.6) | 0 (0.0) | 0 (0.0) | 9 (0.9) | |
| | >12 | 0 (0.0) | 0(0.0) | 2 (1.0) | 0 (0.0) | 0 (0.0) | 2 (0.2) | |
| Sting time during day and night | 0-6 | 53(26.6) | 61 (23.6) | 43 (22.0) | 68(33.7) | 79 (41.4) | 304(29.1) | <0.01 |
| | 6-12 | 37(18.6) | 19(7.4) | 41 (21.0) | 18 (8.9) | 15 (7.9) | 130(12.4) | |
| | 12-18 | 15(7.5) | 32 (12.4) | 29(14.9) | 14(6.9) | 11 (5.6) | 101 (9.7) | |
| | 18-24 | 94(47.2) | 146 (56.6) | 82(42.1) | 102(50.5) | 86 (45.1) | 510 (48.8) | |
| Month | April | 20 (10.1) | 0(0.0) | 5 (2.6) | 11(5.4) | 11 (5.8) | 47 (4.5) | <0.001 |
| | May | 12 (6.0) | 38 (14.7) | 19 (9.7) | 18 (8.9) | 19 (9.9) | 106 (10.1) | |
| | June | 42 (21.1) | 45 (17.4) | 44 (22.6) | 43 (21.3) | 40 (20.9) | 214 (20.5) | |
| | July | 40 (20.1) | 57 (22.1) | 29 (14.9) | 38 (18.8) | 30 (15.7) | 194 (18.6) | |
| | August | 19 (9.5) | 33 (12.8) | 30 (15.4) | 36 (17.8) | 24 (12.6) | 142 (13.6) | |
| | September | 17 (8.5) | 31 (12.0) | 15 (7.7) | 23 (11.4) | 24 (12.6) | 110 (10.5) | |
| | October | 24 (12.1) | 18 (7.0) | 18 (9.2) | 23 (11.4) | 13 (6.8) | 96 (9.2) | |
| | November | 10 (5.0) | 11(4.3) | 15 (7.7) | 4 (2.0) | 12 (6.3) | 52 (5.0) | |
| | December | 4 (2.0) | 5 (1.9) | 4 (2.1) | 3 (1.5) | 6 (3.1) | 22 (2.1) | |
| | January | 1 (0.5) | 2 (0.8) | 3 (1.5) | 1 (0.5) | 2 (1.0) | 9 (0.9) | |
| | February | 4 (2.0) | 10 (3.9) | 1 (0.5) | 0 (0.0) | 3 (1.6) | 18 (1.7) | |
| | March | 6 (3.0) | 8 (3.1) | 12 (6.2) | 2 (1.0) | 7 (3.7) | 35 (3.3) | |
| Total | | 199 (100) | 258(100) | 195 (100) | 202 (100) | 191 (100) | 1045(100) | |

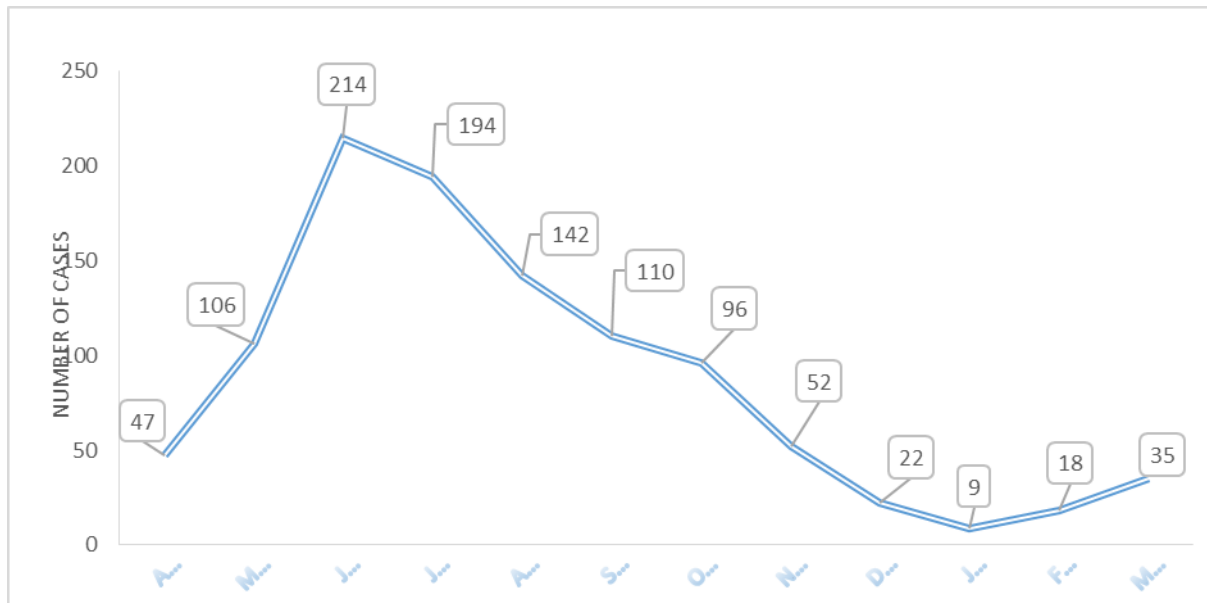


Figure 1: Trend of scorpion sting cases frequency in Khorramshahr County, Khuzestan province, southwestern Iran (2013 - 2017)

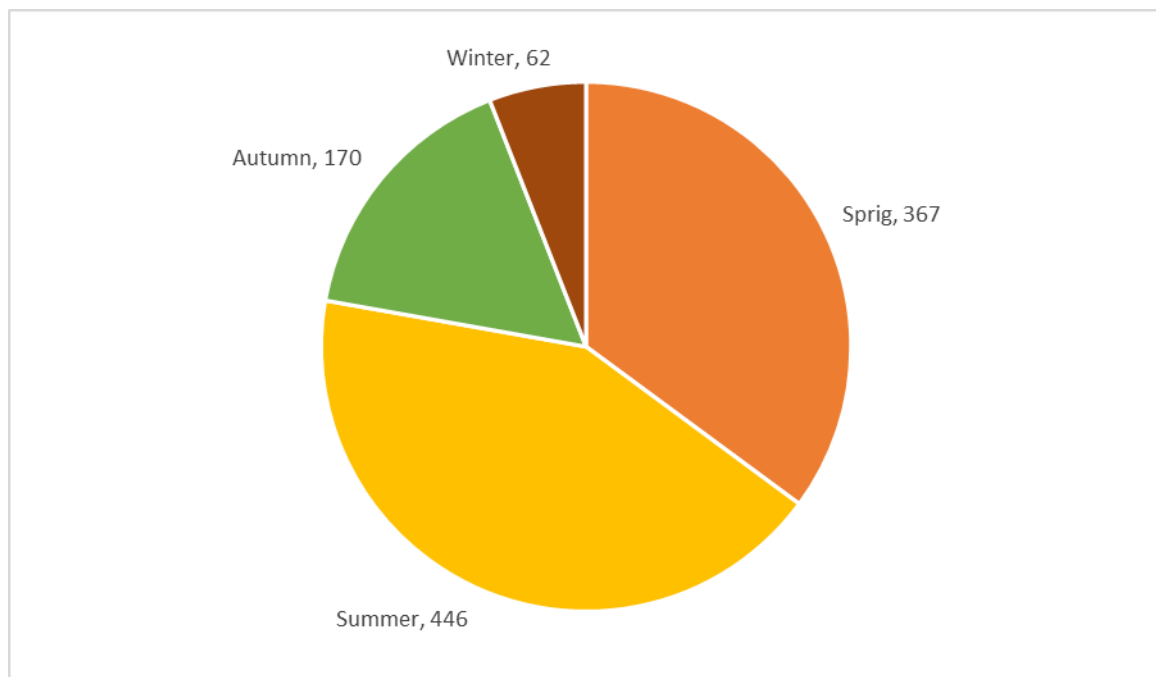


Figure 2: Seasonal distribution of the scorpion sting cases in Khorramshahr County, Khuzestan province, southwestern Iran (2013 - 2017).

DISCUSSION:

Iran is one of the countries with numerous species of scorpions, especially dangerous ones, due to its climatic conditions. The situation re-

garding scorpion sting cases varies in different regions and countries based on lifestyles, socio-economic status, housing conditions, healthcare systems and scorpion species [11].

In this study, 1045 cases of scorpion stings were studied during 2015-2017. There were more cases of scorpion stings among men compared to women. In the study by Talebian et al. in Kashan County (Central Iran), scorpion sting cases were slightly more frequent in males than females (with 52 and 48% of the total cases, respectively) [12]. In addition, in the research by Kassiri in Masjed Soleyman County (southwestern Iran), 50.5% of the scorpion stung persons were male and the rest were female, which is consistent with the percentages, found in the present study [13]. In the study by Osnaya-Romero in Mexico, it was found that 63% of scorpion sting cases occurred in males [14]. Research by Pardal in Brazil on 72 victims of scorpion stings showed that 84.3% of them were male [15]. There is a higher prevalence of scorpion sting cases in men than in women due to men's greater activity level outdoors and in deserts, agricultural fields, and animal husbandry.

Age is one of the most important demographic indicators that are surveyed in most studies aimed at introducing health strategies [16]. In the present study, most scorpion sting cases occurred in the age group above 50 and under ten years. Talebian and Doroodgar studied the epidemiological indicators of scorpion sting cases in Kashan and reported that the highest prevalence of scorpion sting cases happened in the 0-9-year-old age group (36.5% of the total) and the lowest in the age group over 70 years (3.8% of the total) [9]. In the study by Attamo et al., it was reported that most of the victims belonged to the lower age groups [17]. Osnaya-Romero et al. reported that scorpion sting cases were more common in childhood and among boys [14]. In studies by Kassiri et al., 24.8% of scorpion sting cases were reported from Mahshahr County (southwestern Iran) and 25.9% from Abdanan County (southwestern Iran) among 21-30-year-old people [18, 19]. The reasons for the high prevalence of scorpion sting cases in this age group can include curiosity, risk-taking, and behaviors such as lifting stones and not inspecting clothes and shoes before putting them on to make sure there are no scorpions in them.

Classifying information on scorpion sting cases based on the geographical distribution of their dwellings can be helpful in the control of the

problem, focusing education in health centers and even in providing anti-scorpion venom serum for them. Lack of anti-scorpion venom serum in geographical locations with very high prevalence rates might lead to delays involved in taking the victims to other health centers. The present study showed that most scorpion sting victims (61.2% of the total) lived in urban areas. In the studies by Kassiri et al. in Mahshahr [19], Aghajari County [20] and Masjed Soleyman [13], 63.2, 55.7 and 69.7% of the victims resided in urban areas, respectively. In the research by Farghly et al., it was reported that in many countries most scorpion sting cases occurred in rural areas [21]. Talebian also reported in his study that the majority of victims (58.3%) were from rural areas [22]. This finding is inconsistent with the results of the present study. Given that most scorpion sting cases occurred in urban areas in Khorramshahr County, the best way to prevent scorpionism is to renovate and improve old houses and to collect and dispose garbage and construction wastes properly. In places where scorpions are usually observed, it would be better to monitor wet areas in warehouses, under tiles and beside carpets, and places where clothes, bedding, and shoes are kept, more closely.

Scorpions spend the day hiding in safe places and leave their lairs at night to hunt. In this study, it was found that most scorpion sting cases (48.8% of the total) occurred between 6 pm to 12 am followed by 12 am to 6 am with 29.1% of the cases. In studies by Kassiri et al. in Aghajari and Masjed Soleyman Counties, 34.7 and 50.9% of scorpion sting cases happened from 12 am to 6 am [13, 20]. The study by Hosseinasab in Kerman Province (Southern Iran) showed that toxication symptoms in people who were stung at night were more severe than other times so that 63.7% of the victims stung in the early hours of the night exhibited severe symptoms [23]. A scorpion may hunt several times during a single night, which will gradually decrease its store of toxin [24]. Scorpions usually spend the day in safe places such as crevices in walls, under rocks, among the litter, under mats and wood chips, between leaves or under loose bark of trees such as Eucalyptus, inside cracks in palm tree trunks, among construction wastes, and even inside shoes, boots, and closed-

toe slippers. They leave their safe places at night to hunt [25].

In this study, 42.7% of scorpion sting cases occurred in the summer. The vast majority of global reports also indicate that most scorpion sting cases happen in summer [26, 27]. In Kassiri's studies, most scorpion sting cases were reported in July and August in Behbahan County (southwestern Iran) [28], and in July in Abdanan [19]. As scorpions hibernate in winter, their activity in this season diminishes sharply, which can reduce scorpion sting cases in winter. In this study, most scorpion sting cases took place during summer possibly due to increased scorpion activity in warm months. Moreover, scorpion venom in winter is less concentrated than in summer and spring. Therefore, another reason to visit more scorpion sting cases to hospitals in summer may be increased venom concentration and volume in this season.

Mortality caused by scorpion stings is associated with many factors including season, age of the victim, geographical area, scorpion species, and their habitats among which scorpion species plays the most important role [25]. Based on the color of invasive scorpions, 58.5% of the cases were related to black scorpions and 41.5% to yellow scorpions. According to a study by Dehghani in Kashan, 30% of the 200 cases of scorpion sting cases were caused by black scorpions, 62% by yellow scorpions and 8% by unknown species [27].

According to the findings of the present study, the legs (62.5% of the total scorpion sting cases) were more prone to scorpion stings than other limbs. In the study by Talebian, 64.3% of victims had stings on the lower limbs, 27.8% on the upper limbs, 7.4% on the trunks and 0.5% on the heads and necks [12]. Scorpion stings on the lower extremities can be related to the lack of proper footwear in the yard or on farmland. Moreover, when people are resting before sleep, the lower limbs are less visible than the upper limbs, and people are less likely to notice a scorpion is approaching their legs.

Delayed visit to medical centers after scorpion sting cases plays a role in an increased likelihood of death and appearance of severe clinical symptoms. About 72.6% of the victims were

treated with anti-scorpion venom serum less than 1.5 hours after the incident. Similar delays between scorpion stings and anti-scorpion venom serum administration have also been reported in other similar studies [29]. In a study in Mexico, this delay was less than 30 minutes in 48% of the cases [30]. Delayed visit to medical centers is caused by people's ignorance of the important receive the anti-scorpion venom serum as soon as possible has for the victims. In addition, they may be unable to reach emergency services rapidly due to financial or geographic barriers. Informing the public about the importance of receiving rapid treatment after scorpion stings will be effective in reducing delays in taking those stung by scorpions to medical centers and preventing the consequences of these delays.

CONCLUSION:

This study suggests the necessity of preventive and control programs for decreasing the incidence of scorpion sting cases. Early treatment is particularly significant for infants and children. Researches on bio ecology of scorpions in the county and various control methods are recommended.

Acknowledgments:

This study was financially supported by the Research Deputy, Ahvaz Jundishapur University of Medical Sciences (Project No. 330095309). The authors' deep gratitude goes to the health staff of Khorramshahr, Khuzestan Province for their collaboration.

Conflict of Interests:

The authors of this article declare that they have no competing interests.

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