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Incidence rate of animal bites in southern Iran during 2015-2019 using Cochrane-Armitage trend test

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ABSTRACT

Objective: To investigate the trend of animal bites in southern Iran from 2015 to 2019.

Methods: This is a cross-sectional study of patients with animal bites who were referred to the Center for Disease Control in the three cities of Larestan, Evaz, and Khonj in Fars province, southern Iran from 2015 to 2019. The trend of animal bites incidence was analyzed using the Cochran-Armitage trend test.

Results: In total, from 2015 to 2019, 1 944 cases of animal bites were reported. A total of 79.8% of the cases were men. The overall average incidence of animal bites was 142.93 per 100 000 people. The incidence of animal bites was significantly increased (P_{trend}<0.001). The highest incidence was in November (79.04 per 100 000 people) followed by January (76.1 per 100 000 people) and February (69.48 per 100 000 people); also, the lowest incidence was in August (47.42 per 100 000 people) and July (50.0 per 100 000 people).

Conclusions: The incidence of animal bites has significantly increased. Given the importance of rabies, control and management of animal bites should be emphasized and considered.

KEYWORDS: Rabies; Animal bites; Epidemiology; Iran; Trend; Incidence

1. Introduction

Animal attacks on humans continue to be a major medical and social problem worldwide[1]. Wild and domestic animal bites cause many health problems, including wound infection, trauma, and contact with the rabies virus, which can lead to death[2]. The main source of rabies infection is bite[3]. Rabies is a very dangerous viral disease that can affect all mammals[4]. Rabies virus agent (Lyssavirus and Rhabdoviridae) causes fatal encephalitis[5,6]. In Europe, Asia, and Africa, the disease is transmitted by dog bites, and in the United States by bat bites[5]. Rabies is a 100% fatal disease that can be 100% preventable if treated promptly after exposure to animal bites. However, not all people who are bitten by an animal seek appropriate treatment[7]. The average incubation period of rabies in

Significance

Animal bites are one of the endemic diseases in Iran, the increasing trend of which imposes major economic and health problems on the individual and the society. The results of the present study can be of great help in understanding the epidemiological situation of this disease and predicting its occurrence in health centers and universities of medical sciences.

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humans is about 2 to 3 months. This period depends on the location of the wound, depth of the wound, concentration, virulence of the virus inoculated or isolated, and the distance between the wound and the brain or spinal cord[8]. Moreover, more than 40 percent of all animal bites occur in kids under 15 years of age[9]. The World Health Organization estimates that more than 2.5 billion people worldwide are at risk of rabies, and the disease has been reported in more than 100 countries[10]. About 10 million people worldwide receive rabies-related treatments and rabies prevention each year. However, about 50 000 to 60 000 people die of the disease[11]. Most cases of rabies are reported in developing countries[12]. In Asia, in eight countries (Japan, Malaysia, Qatar, Bahrain, Taiwan, Singapore, and Hong Kong) rabies has been eradicated and no positive cases have been reported in recent years[13]. However, rabies has been present in Iran since the past, and the most important reservoirs of this disease have been dogs and cats[14]. Studies have recently shown that the incidence of rabies in Iran has increased[15], and in most provinces and cities of Iran, it exists in wild and domestic forms[11,16]. This disease can cause great economic and social costs to the individual, society, and health systems in Iran. Knowledge of the epidemiology of animal bites and related factors in post-exposure treatment is essential to prevent the human from rabies[17]. This can help to plan and evaluate health interventions[18]. The present study was designed to determine the trend of animal bites in Larestan, Evaz, and Khonj counties in the south of Fars province, southern Iran, from 2015 to 2019.

2. Patients and methods

2.1. Study design

This analytical cross-sectional study included all individuals with animal bites who were referred to the Center for Disease Control in three cities of Larestan, Evaz, and Khonj in Fars province, southern Iran, from 2015 to 2019 (Figure 1).

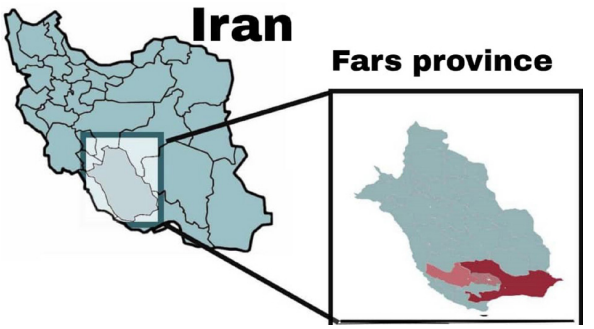


Figure 1. Geographical information of the study area.

2.2. Ethical statement

It was approved by Larestan University of Medical Sciences with the Code of Ethics IR.LARUMS.REC.1399.007.

2.3. Data gathering

Two trained researchers collected the data. They reviewed the patients' health records by regularly referring to the Infectious Diseases Control Center of Larestan University of Medical Sciences and presenting their letter of introduction. To gather the information, we used a standard form that included items such as age, nationality, sex, place of residence, and month and year of the occurrence of animal bite. The researchers investigated all records of animal bite cases in the Center for Communicable Diseases of Larestan from 2015 to 2019 through daily visits. For some records with incomplete information, researchers assisted them by receiving additional information over the phone to minimize the missing data.

2.4. Statistical analysis

SPSS statistical package version 19 was used to analyze the data. Enumeration data were presented as frequency and percent, and analyzed by Chi-square test. The trend of animal bite incidence was analyzed using the Cochran-Armitage trend test. $P<0.05$ was considered significant difference.

3. Results

3.1. Demographic characteristics

In general, from 2015 to 2019, a total of 1 944 cases of animal bites have been reported in the south of Fars province. Men were significantly ($P<0.001$) more exposed to animal bites than women (79.8% versus 20.2%). Most cases of infection have been observed in the age group of 19 to 30 years, and a significant difference ($P<0.001$) was observed between different age groups according to the year of occurrence of the disease. A total of 63.5% of the people bitten by the animals lived in the city, while 3.1% were nomads. Most of the cases were Iranians (Table 1).

3.2. Overall annual incidence

The overall average incidence of animal bites was 142.93 per 100 000 people. The results of Cochrane-Armitage trend test showed that the incidence of animal bites was significantly increased ($P_{Trend}<0.001$). The incidence of animal bites increased from 109.92 in 2015 to 189.33 per 100 000 people in 2019 (Figure 2).

Table 1. Demographic characteristics of animal bites cases in the south of Fars province, south of Iran, 2015-2019.

Variables	*n*	%	χ^2	*P*
Sex				
Female	393	20.2	15.43	0.004
Male	1 551	79.8		
Age (years)				
≤18	488	25.1	36.34	0.001
19-30	540	27.8		
31-45	497	25.6		
>45	419	21.6		
Residency				
Rural	651	33.5	53.57	0.001
Urban	1 235	63.5		
Nomad	58	3.0		
Type of biting animals				
Dog	1 068	54.9	31.37	0.001
Cat	444	22.8		
Other	432	22.2		
Nationality				
Iranian	1 873	96.3	4.13	0.387
Non-Iranian	71	3.7		

3.3. Overall incidence in month

The highest incidence was in November (79.04 per 100 000 people), followed by January (76.1 per 100 000 people) and February (69.48 per 100 000 people), and the lowest incidence was in August (47.42 per 100 000 people) followed by July (50.0 per 100 000 people) (Figure 3).

3.4. Overall incidence in the day

In terms of the prevalence by the day, the highest incidence was on the 18th day of each month and also the first days of the month, and the lowest was on the last days of the month. In general, most cases happened in the middle and beginning of each month, and fewer in the last week of each month (Figure 4).

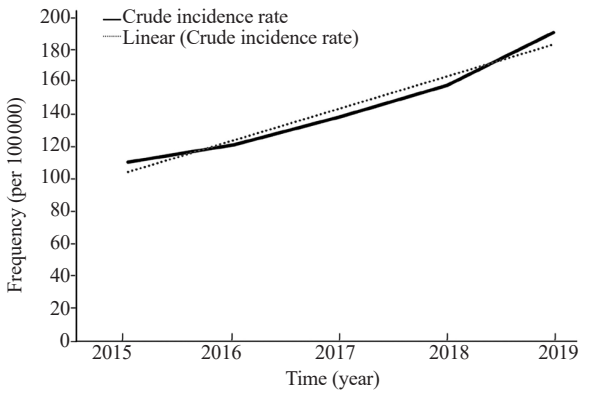


Figure 2. Trend of annual incidence of animal bites in the south of Fars province, southern Iran, 2015-2019.

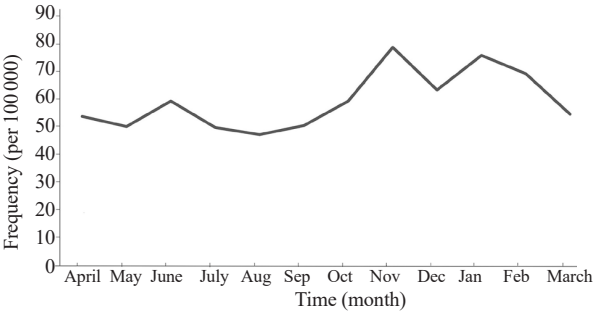


Figure 3. Trend of monthly incidence of animal bites in the south of Fars province, southern Iran, 2015-2019.

3.5. Overall incidence in the time

A comparison of cases by the time of disease onset revealed that most cases of animal bites were reported at 10, 15, and 20 o'clock, and the lowest percentage of them occurred in the early hours of midnight to early morning (Figure 5).

4. Discussion

The finding of the present research showed that the incidence of animal bites in the southern region of Fars province, southern Iran, from 2015 to 2019 increased significantly from 109.92 to 189.33 per 100 000 cases. A similar study in Iran indicated that the incidence of bites increased from 492 cases (per 100 000 people) in 2013 to 652 cases (per 100 000 people) in 2020, which is much higher than the finding of the current study[19]. A study in the United States reported that the prevalence of dog bite injuries was declining from 2010 to 2014[20]. A meta-analysis of the epidemiology of animal bites in Iran from 1993 to 2013 showed that the overall incidence rate was 13.2 per 1 000 people and the uppermost incidence of the disease was in the province of West Azerbaijan in north-western Iran[20]. In general, it seems that the incidence of animal bites in Iran has been increasing in recent years[19]. Probable reasons for the increase in animal bites in Iran in urban areas are mostly the presence of trained animals such as dogs and cats with families, which leads to more people being exposed to the bites of these animals, as well as the presence of people in zoos and parks. The habitat of the animals has increased the likelihood of bites; on the other hand, in rural and nomadic areas, given that most people work in the traditional way of livestock, agriculture and herding, their close contact with livestock, horses, donkeys, herding dogs and other wild animals can lead to animal bites[21]. The present study also showed that most cases of the disease were reported from urban areas.

More than $8.6 billion is spent annually on the costs of human rabies, the highest cost of all premature deaths in Asia and Africa[22]; also, according to the research carried out in 2018 in the north of Iran regarding the estimation of the costs of prevention and control

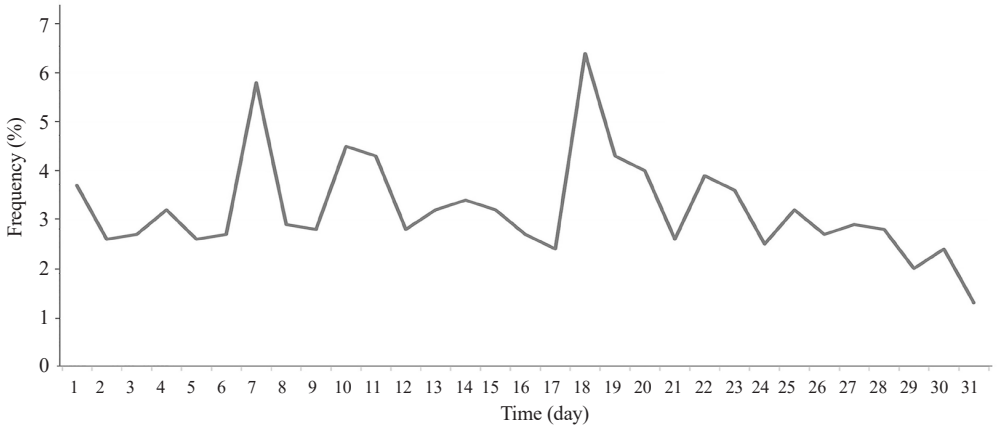


Figure 4. Percentage of animal bites by the time of accident.

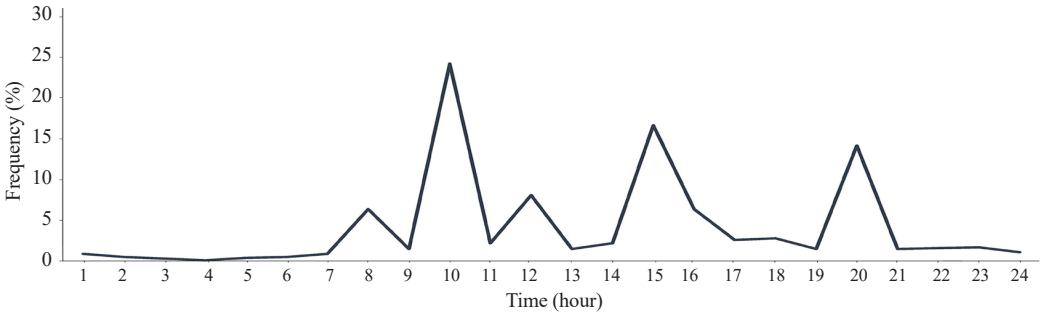


Figure 5. Percentage of animal bites by the day of the accident.

of rabies, it indicates the high cost of control and prevention of this disease for the government[23]. The finding of the current study showed that men were significantly more bitten than women, which was similar to other studies[24,25]. Men seem to be more prone to animal bites than women due to more contact with animals as a result of job requirements as well as more audacity[26].

The current research revealed that, in general, the mean age of the bitten people was about 33 years, and it decreased significantly from 2015 to 2019. Various studies reported different results about age groups. One study found that most cases occurred at the ages less than 15 years[27]. A research in Yemen showed that most cases of bites happened between the ages of 5-14 years[28]. A meta-analysis study conducted in Iran reported a mean age of 26.23 years[17]. Given that most studies have reported more cases of the disease in young and adolescent age groups, it seems that this group of people is at higher risk for bites; this could be due to more exposure and less care of these people in dealing with animals, especially domestic dogs and cats; they might be inadvertently bitten.

The finding of this research indicated that the incidence of bites in November, January, and February was higher than in other months. A research in Western Iran also concluded that most cases happened in spring[14], but another study showed that most cases of the disease happened in spring and summer[29]; still, another study in Iran revealed that most cases were in spring[17]. Babazadeh *et al*. in their research conducted in North-western Iran between 2008 and 2014 pointed out that the maximum cases of animal bites occurred in summer and spring and the minimum in winter. Most bites also occurred in July and August. Instead, the lowest rate occurred in January[30] which is not consistent with the results of our research. It seems that factors such as climatic diversity and geographical areas can be the reason for these differences. As mentioned in the current research, most of the cases were related to winter and autumn. It seems that agricultural and livestock activities in this region are more prosperous in autumn and winter. On the other hand, the activities and entertainment of the inhabitants and their presence in nature should be more in autumn and winter due to the weather conditions throughout the year.

The finding of the current research indicated that the incidence of bites was higher in the early and middle days of the month, and the closer we get to the end of the month, the lower the prevalence of the disease will be.

This research also showed that most cases occurred in the early and mid-morning, afternoon, and early evening. One research stated that the uppermost percentage of bites happened in the afternoon (12 to 18 in the afternoon) and the lowest was in the morning (6 to noon)[30]. Another similar study found that 38.56% and 29.3% of

all bites occurred in the evening and morning, respectively, and this seems to be mostly because the above-mentioned times coincided with the hours of commuting to school or work and people leaving home[31].

One of the limitations of our research was the absence of access to some epidemiological data related to animal bites, which could not be estimated and compared due to the high volume of missing and incomplete data.

The finding of the present research revealed that the incidence of animal bites in the south of Fars province, southern Iran, was significantly growing. Given the importance of rabies, control and management of animal bites should be emphasized and considered. Another major measure is the fight against rabies in wild animals that are in contact with humans. The development of identification and vaccination of domestic and herd dogs by the General Veterinary Administration and the follow-up of their vaccine and health card can also largely prevent the occurrence of rabies. Since most of the cases of animal bites occur in adolescents and among students, special attention should be paid to this group to increase their level of awareness about rabies, so that they do not approach the congregation places of stray dogs, do not stimulate them, and apply protective measures when dealing with stray dogs; these play an important role in reducing animal bites. On the other hand, educational programs are recommended to increase public awareness. People should refrain from keeping dogs and cats at home, except for collaring and vaccinating them against rabies, as well as refrain from pet dogs in public parks. And in the event of any behavior change in animals, the owner should notify the General Veterinary Administration immediately.

Conflict of interest statement

The authors report no conflict of interest.

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Authors' contributions

HD: study design, supervision, methodology, analysis and original draft preparation. AE and ZK: investigation and conceptualization. OS and BR: critical revision of the manuscript for important intellectual content. MRB: original draft preparation and interpretation of data.

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