ORIGINAL ARTICLE

Epidemiological Patterns of Animal bite in the North of Khorasan Province in Iran

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Abstract

Background: Rabies is one of the important diseases and is usually transmitted by the bite of infected animals. This study investigated the epidemiological situation of animal bites in northeastern Iran from 2017 to 2021.

Methods: This is a cross-sectional study. Sampling was done by census, and all animal bite cases, including 3679 people, were enrolled in the study. Cases of animal bites registered at the rabies treatment centers by Esfarayen County in the North of Khorasan province, from 2017 to 2021, were analyzed. The tool for collecting information was the portal of the Ministry of Health, and SPSS version 26.0 was used for data analysis.

Results: The mean age of the subjects under study was 33.9±20.4 years; of them, 2636 (71.6) were men and 838 (22.8) were students. 1448 (97.6%) of those with upper body injuries referred to the health center for less than 48 hours. 2024 (94.3%) were bitten by a dog and most of the bites (N=1055, 28.7%) happened in spring. The incidence of animal bites was 25.54 per thousand people. The trend has increased since the beginning of the study from 476 per 100,000 in 2017 to 648 per 100,000 in 2021 (P<0.001).

Conclusion: Considering the increase in animal bite cases in Esfarayen County and the loss of life and money caused by it, including the risk of rabies transmission and increasing costs of vaccination and serum therapy, the cooperation of related organizations and interventions is necessary to reduce animal bite cases.

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Introduction

Rabies is one of the most important diseases that can be transmitted between humans and animals (zoonosis) and is usually transmitted to humans through the bite of an infected animal. The transmission of the rabies virus to humans causes an acute and fatal neurological infection; to prevent the death of people, it is necessary to take preventive measures immediately after exposure.[1] Most bites are caused by dogs.[2,3] Premature death and, as a result of the reduction of income and economic productivity, is one of the most serious effects of dog rabies.[4] Most of the reported cases of bites are related to developing countries, especially from Asian and African countries, where 99% of the deaths are reported.[3-5] Asian countries have the highest disease burden, and according to the World Health Organization (WHO), 31,000 rabies-related deaths occur in these countries annually.[5] It is estimated that India accounts for more than 35% of the global burden of rabies.[4] Rabies is endemic in Iran and affects both wild and domestic animals.[6] Every year, more than 100,000 people in Iran undergo preventive anti-rabies treatment due to being bitten by animals, especially dogs.[7] Animal bites are highly prevalent in young men under 14 years of age, and approximately 30-40% of preventive treatments are performed in this group.[6-8] In general, high costs are spent on providing rabies vaccines and immunoglobulins to vaccinate animal bite victims.[9] Most cases of animal

bites in Iran occur in rural areas.[6-10] Also, the increase in outdoor activities and travel to rural areas cause a change in the incidence of animal bites in different seasons of the year.[11] According to the guidelines, all cases of animal bites in Iran, as suspected rabies bites, are immediately subjected to rabies prevention treatment measures.[12] In Iran, the incidence of animal bites shows an upward trend but is currently under control.[12] The climatic diversity and geographical location of Iran should be studied separately in different regions of the country. Monitoring and improving the reporting of animal bite cases are needed to better assess the burden of this public health problem and evaluate control efforts. This study was conducted to analyze the characteristics of animal bites using descriptive epidemiological methods and statistical analysis in Esfarayen County in northeastern Iran between 2017 and 2021 to better control animal bites and prevent rabies.

Methods

Study Design and Setting

This is a cross-sectional study. The samples of this study included all the residents of Esfarayen County in Eastern Iran between 2017 and 2021 who referred to the rabies prevention center to receive treatment due to animal bites. Sampling was done by census and all animal bite cases including 3679 people were enrolled in the study.

Inclusion and Exclusion Criteria

Data of the animal bites were collected based on the checklists available from the records of the city health center. All individuals' names were blinded and reported to the researchers. The exclusion criterion was individuals who were not residents of Esfarayen County.

Data Collection

The collected information included the demographic characteristics of the participants, where people live (rural or urban), the place of the bite, the biting animal, whether the biting animal is domestic or wild, the injured limb (lower, upper), the type of wound (superficial, deep), frequency of rabies vaccination (3 times, 5 times), delay in vaccination, serum therapy in case of bite, and the condition of the biting animal.

Statistical Analysis

Frequency and percentage were used to describe the categorical variables, and mean and standard deviation were used to describe the continuous variables. The chi-square test was used to determine the relationship between the type of injury and the variables related to the animal bite.

Table 1: Characteristics of the victims and biting animals referred to health centers in Esfarayen County, Iran (2017-2021)

Variable	Subcategory	N (3679)
Age	0-9 years	450 (12.2)
	10-19 years	670 (18.2)
	20-29 years	543 (14.8)
	30-39 years	584 (15.9)
	40-49 years	461 (12.5)
	50-59 years	463 (12.6)
	≥60 years	508 (13.8)
Gender	Male	2636 (71.6)
	Female	1043 (28.4)
Living place	Village	2589 (70.4)
	City	1024 (27.8)
	Other *	66 (1.8)
The location of the bite	In travel	64 (1.7)
	At residence	3615 (98.3)
Season	Spring	1055 (28.7)
	Summer	879 (23.9)
	Autumn	900 (24.5)
	Winter	845 (23)
Job	Student	838 (22.8)
	Free job	773 (21)
	Householder	757 (20.6)
	Farmer and rancher	544 (14.8)
	Employee	134 (3.6)
	Other **	633 (17.2)
The fate of the biting animal	Under supervision	3318 (90.2)
	Killed	34 (0.9)
	Other ***	327 (8.9)

* City outskirts and Nomads; ** Child, Driver and...; *** Fugitive

The Kruskal-Walli's test was used to show the average age of the victims based on the bite site variable (upper body and lower body). We also calculated the incidence of animal bites per 10000 people using the 2021 population as the denominator. Due to the descriptive and cross-sectional nature of this study, there were no confounding and interaction variables, and since all people were included in the study by the census, there was no missing data. SPSS version 26.0 was used for data analysis, and we set parameters in the confidence interval of 95%.

Results

During the study period, 3679 animal bite victims (25.54 per 1000) were referred to health centers and interviewed. The mean age of the subjects under study was 33.9±20.4 years; of them 2636 (71.6) were men and 838 (22.8) were students. Most of the bites (N=1055, 28.7%) happened in spring, especially in May (N=374, 10.2% and N=353, 9.6 %); they happened in the village (N=2589, 70.4%), and more than 90% of biting animals were under supervision (Table 1).

According to Table 2, 1448 (97.6%) of those with upper body injuries referredt to the health center for less than 48 hours, 1287 (86.8%) had incomplete vaccination, 1224 (82.5%) did not receive serum treatment, 1317 (88.8%), and people were bitten by a domestic animal; of those with lower body injuries,

Table 2: Factors related to injuries in patients referred to health centers in Esfarayen County, Iran (2017-2021)

Variable	Body injury site			P value
	Upper, N (1483)	Lower, N (2146)	Both, N (3679)	
Delay in zero-round vaccination				
>48 hours	35 (2.4)	43 (2)	0 (0)	0.442
<48 hours	1448 (97.6)	2103 (98)	50 (100)	
Vaccination status				
No vaccination	2 (0.1)	4 (0.2)	0 (0)	
Complete vaccination	194 (13.1)	225 (10.5)	6 (12)	0.199
Incomplete vaccination	1287 (86.8)	1917 (89.3)	4 (88)	
Washing the wound				
No	92 (6.2)	48 (2.2)	0 (0)	<0.001
Yes	1391 (93.8)	2098 (97.8)	50 (100)	
Serum therapy				
No	1224 (82.5)	1969 (91.8)	44 (88)	<0.001
Yes	259 (17.5)	177 (8.2)	6 (12)	
Animal species				
Dog	1153 (77.7)	2024 (94.3)	44 (88)	
Cat	263 (17.7)	85 (4)	5 (10)	<0.001
Other*	67 (4.5)	37 (1.7)	1 (2)	
Animal status				
Domestic	1317 (88.8)	2021 (94.2)	46 (92)	<0.001
Non-domestic	166 (11.2)	125 (5.8)	4 (8)	
Scratches on the skin				
No	169 (11.4)	134 (6.2)	2 (4)	<0.001
Yes	1314 (88.6)	2012 (93.8)	48 (96)	

* Donkey, horse, cow, fox, wolf and rat

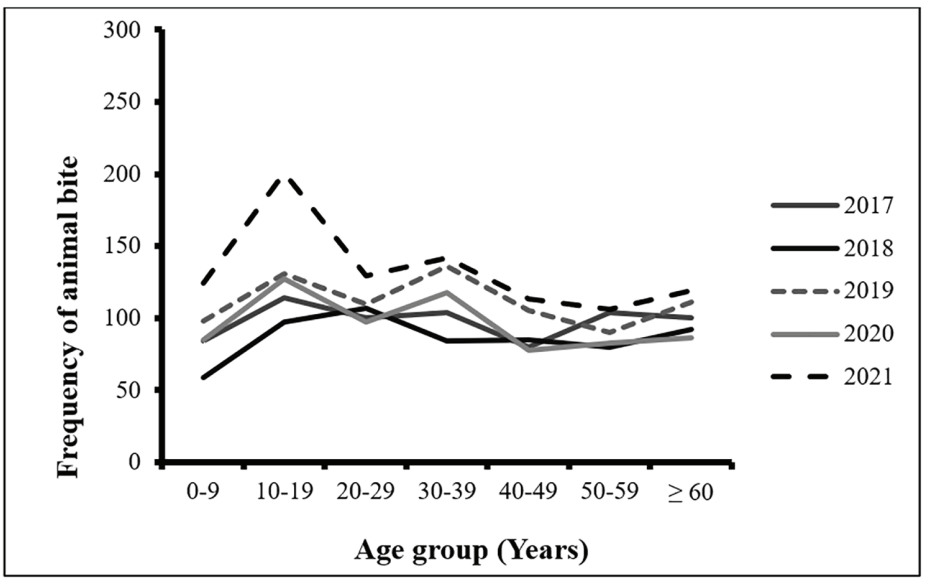

Figure 1: Distribution of animal bite cases by age groups and by year in the health center of Esfarayen County, Iran (2017-2021)

1917 (89.3%) had incomplete vaccination, 2024 (94.3%) had dog bites, and 2024 (94.3%) had skin scratches.

The results of Kruskal Wallis showed that there was a statistically significant difference in the mean age of the victims, which was higher for those with injuries to the upper body (P<0.001). According to the chi-square results, 62.1% of those who lived in the village were injured in the lower body and 49.5% of those who lived in the city were injured in the upper body (P<0.001). The obtained results showed that among all animal bite cases, the age group of 10-19 years had the highest frequency compared to other age groups (Figure 1).

It was also observed that among those who were bitten by dogs, the highest number was in the age group of 10-19 years in men (N=497, 21.1%) and over 60 years old in women (N=194, 22.6%). In addition, among those who were bitten by cats, the highest number was in the age group of 10-19 years in both genders (N=43, 21.5% and N=36, 23.5%, respectively) (Table 3).

The Trend of Animal Bites over Years

According to the Cochran-Armitage test, the trend of animal bites in Esfarayen County has fluctuated over the past five years, but in general, the trend has increased since the beginning of the study from 476 per 100,000 in 2017 to 648 per 100,000 in 2021 (P<0.001) (Figure 2).

Discussion

The present study was conducted to investigate the epidemiological situation of animal bites in Esfarayen County,North of Khorasan province in Iran, during the years 2017 to 2021. In this study, the variables of age, gender, place of residence, place of occurrence, season, occupation, and the fate of the biting animal were investigated. The findings indicated an increase in the number of cases and incidence of animal bites in Esfarayen County compared to other regions of the world. Furthermore, the prevalence of animal bites was much higher in men than in women. Most cases of animal bites were reported in the age group of 10 to 19 years, village residents, the spring season, and students. Moreover, in most cases, the attacking animal was a dog, and the majority of the wounds were also on the lower extremities.

The results of the present study showed that the incidence of animal bites was 648.61 per 100000

Table 3: Distribution of injuries by animal species in different age and sex groups referred to health centers in Esfarayen County, Iran (2017-2021)

Age groups (years)	Male, N (2636)			Female, N (1043)		
	Dog	Cat	Other *	Dog	Cat	Other
0-9	274 (11.6)	35 (17.5)	8 (10.7)	106 (12.3)	23 (15)	4 (13.3)
10-19	497 (21.1)	43 (21.5)	8 (10.7)	83 (9.7)	36 (23.5)	3 (10)
20-29	407 (17.2)	33 (16.5)	8 (10.7)	74 (8.6)	17 (11.1)	4 (13.3)
30-39	418 (17.7)	36 (18)	17 (22.7)	89 (10.3)	19 (12.4)	5 (16.7)
40-49	269 (11.4)	23 (11.5)	9 (12)	137 (15.9)	18 (11.8)	5 (16.7)
50-59	245 (10.4)	16 (8)	6 (8)	177 (20.6)	16 (10.5)	3 (10)
>60	251 (10.6)	14 (7)	19 (25.3)	194 (22.6)	24 (15.7)	6 (20)

* Donkey, horse, cow, fox, wolf and rat

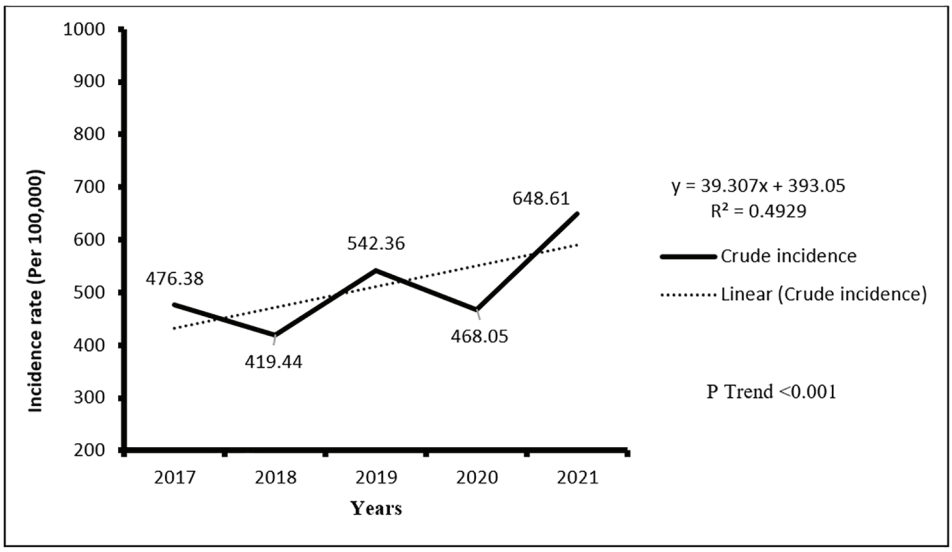

Figure 2: Incidence rate of animal bites per year in the health center of Esfarayen County, Iran (2017-2021)

(2021), which is higher than that in other regions. Thus, the incidence of animal bites in Turkey (annually) is up to 52.7 per 100000,[13] in United States (1998) 12.9 per 10000,[14] and in Rostam City (2020) 404 per 10000;[15] in Jahrom City from 2014 to 2018, the overall incidence rate was 1716 per 100000,[16] while in India (2020), an incidence rate of 78 per 1000 has been reported, which is much higher than that in the present study.[17] The increasing incidence of animal bites in most regions can be attributed to increased human population, increasing numbers of stray dogs, and increased public awareness about animal bites and their consequences. This situation causes most cases of animal bites to be referred to rabies prevention and control centers. Also, improving the animal bite registration and reporting system and developing tourism in rural and forested areas are effective in increasing animal bite cases.

The current study showed that the prevalence of animal bites in men was significantly higher than in women, which is consistent with the results of previous studies conducted in Mashhad and Tehran City in Iran.[10-18] It seems that the reason for the higher prevalence of animal bites in men is because more men perform daily tasks in environments outside the home and that men have closer relationships with trained and stray dogs, which is why men are at risk and have more contact with animals, especially in rural areas. In a study in Poland, the results showed that the number of animal bite cases in men and women was similar.[19] This issue is due to cultural differences between different countries.

In the present study, the age group of 10 to 19 years had more animal bites than other age groups, followed by the age group of 30 to 39 years and 20 to 29 years, which was consistent with the results of studies in Golestan and Isfahan province in Iran.[20, 21] However, in several studies in Tehran and Birjand City in Iran, most cases of animal bites were reported in the age group of 20 to 29 years.[18-22] In Turkey in 2023, most cases were reported in the age group of 20 to 44 years.[13] The higher prevalence of animal bites in the age group of 10 to 19 years may be due to attachment to animals, lack of experience, carelessness in contact with animals, and inability to run away from or confront these animals. The high number of animal bite cases in the age group of 20 to 29 years is also due to their active and adventurous nature and provocative movements when facing animals.

The present study showed that the majority of animal bite cases were residents of the village, which is consistent with the results of previous studies in Golestan and North Khorasan province in Iran,[22, 23] while in a study conducted in Khorramshahr City in Iran, the results showed that most of the animal bite cases were residents of the city.[21] The high number of animal bites in rural areas can be due to farming and animal husbandry, people's lifestyle, and especially the presence of a large number of stray dogs in the villages which increases their contact with animals, and this leads to an increase in the risk of animal bites. The high number of animal bites in cities can also be due to the larger population compared to rural areas.

The present study showed that most cases of animal bites occurred in spring (28.7%), which was consistent with the results of studies in India, Mashhad, and Gorgan in Iran.[6-10-24] Also, in Maku City and Northwest Iran, and in addition, in a systematic review of 33 studies in Iran, most cases of animal bites were reported in the spring season.[25, 26] The reason for the increase in animal bite cases in the spring season may be due to the beginning of the livestock and grazing season and the increase of people visiting rural, recreational, and tourist areas. Also, the presence of more animals in the environment is probably due to the suitable weather conditions of this season, while in Ilam and eastern Iran, most cases of animal bites are reported in the winter season.[27] This difference may be due to the climate differences in different regions of the country.

In the present study, animal bite cases were students, self-employed individuals, housewives, and farmers, respectively, which is consistent with the results of studies in Gorgan and Khorramshahr City in Iran; also, people with student and freelance occupations were bitten by animals more than other occupations.[6-28] Also, a comprehensive systematic review of 33 studies in Iran showed that most cases of animal bites were students.[26] The high prevalence of animal bites in students as well as in the age group under 20 years old, due to the love of animals, lack of experience, and carelessness in contact with animals, taking provocative measures when dealing with animals, especially dogs, numerous high-risk areas, harassment and the abuse of animals, and the inability to run away from or confront these animals. The high number of bites among self-employed workers may also be due to a working environment where they spend a lot of time outdoors and have many opportunities to encounter and interact with animals.

In terms of the fate of the invasive animal, the study found that most of the invasive animals were owned and supervised (alive and healthy after 10 days); only 0.9% of the invasive animals died, and in 8.9% of cases, the fate of the attacking animal was not known. Results from a study in Mashhad City in Iran also showed that most of the invasive animals were owners, which was consistent with the present study.[29] This issue can be due to agriculture and animal husbandry jobs at the village level, the new tendency of citizens to keep pets, the lack of proper maintenance of dogs by their owners, and the lack of collaring, as well as jobs related to animals.

Another study in Iran (2013) showed that most animal bites were caused by domestic animals,[30] which is consistent with the present study. The reason for this issue can be considered the increase in the population of stray dogs and cats, as well as the increase in the number of pets kept at homes.

In the present study, most of the animal bite cases had visited the health centers within 48 hours, most of them had not completed their vaccination, most of the cases had been washed but no serum treatment had been done, and most of them had been bitten by a domestic animal. In studies in Kerman and Ilam provinces in Iran, the results showed that 80% of cases did not complete their vaccination, which is consistent with the present study.[2-31] Another study revealed that only 2.8% of cases referred to a health center more than 48 hours late.[32] The reason for the lack of delay in visiting the health center is the presence of up-to-date guidelines and education of the disease to thepublic, with an emphasis on the flexibility of rabies. Moreover, the reason for not completing the vaccination is that the attacking animal is alive and healthy 10 days after the bite. In this way, three injections of the rabies vaccine are enough, and a fourth injection is not necessary. Serum therapy is also necessary only in cases of deeply bleeding wounds and, exceptionally, non-bleeding superficial wounds in five organs of the head, face, neck, wrists to nails, and genitals.

In this study, of all animal bites, most were reported on the lower limbs, followed by the upper limbs, which is consistent with the results of studies in Iran.[6, 27-33] Previous studies also showed that the bite site was lower in most cases of animal bites.[26-34] Additionally, in a study in India, the results showed that the most common bite site was the lower limb, which is consistent with the present study.[17] Studies in the cities of Mashhad and Azarshahr in Iran showed that the upper limbs were the most commonly bitten sites, which contradicts the results of the present study.[10-29] The reason for the dominance of the lower limbs can be attributed to the fact that the legs are used for defense and scaring away the attacking animals.

According to the results of our study, most of those who lived in the village were injured in the lower limb, and 49.5% of those who lived in the city were injured in the upper part. It seems that the abundance of animal bites in different places is influenced by human lifestyle. Wild animals which exist mainly in villages mostly bite the legs and lower limbs, while in the cities, where there are more pets, the hands and upper limbs are bitten.

In the present study, in most cases of animal bites, the biting animal was a dog, followed by a cat, and then other animals. Also, in cases of male animal bites by dogs, the highest number occurred in the age group of 10 to 19 years and, in the case of females, in the age group over 60 years. The highest number of animal bites caused by cats was in the 10-19-year-old age group for both genders. In most previous similar studies, most cases of animal bites were caused by dogs, followed by cats. The results of studies by Warrell et al., as well as studies in Australia, India, Puerto Rico, Japan, Turkey, and in Birjand and Gorgan Cities in Iran, are consistent with our study.[6, 24, 35-39] In addition, some studies conducted in Iran showed that most of the attacking animals were dogs.[26, 34-40] This can be due to the presence of dogs in most rural households, the presence of a large number of stray dogs, and the lack of collaring of dogs.

The Strengths and Limitations of the Study

One of the strengths of this study is the investigation of the epidemiological situation of animal bites over 5 years, the evaluation of the trend of animal bites over 5 years, the large number of studied samples, and the comprehensiveness of the study in terms of the number of investigated variables. One of the limitations of this research was its descriptive method. Also, in this study, the factors related to the delay in receiving anti-rabies vaccine and immunoglobulins have not been investigated in people with animal bites.

Conclusion

For preventive measures and animal bite control in any region, it is necessary to know the epidemiological situation of this phenomenon in that society. Rabies infections and deaths can be prevented through education and awareness of high-risk groups, following animal bite prevention guidelines, rabies vaccination, and immunizing the pets. The results of this study can play a role in promoting animal bite guidelines. Considering the increase in animal bite cases in Esfarayen County and the resulting human and financial damages, the cooperation of related organizations and interventions are necessary to reduce animal bite cases. With the increase in the population of stray dogs and since most cases of animal bites have occurred by dogs, it is recommended that the vaccination of domestic dogs should be considered, and awareness of the dangers of being bitten by them should be increased.

Authors' Contribution

HK: provided guidance in conducting the study, conceptualized the study plan, and edited and reviewed the manuscript. ML: contributed to interpreting the findings and drafting the manuscript. FJ: analyzed the data, interpreted the results, and wrote the manuscript. MM: analyzed the data and wrote the manuscript. SK: compiled and prepared the final data set for analysis, reviewed the analysis, and wrote the manuscript. All authors read and approved the final manuscript for publication.

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Ethical Consideration

This study was approved by the Ethics Committee of Esfarayen Faculty of Medical Sciences with IR.ESFARAYENUMS.REC.1402.001.

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Conflict of Interest: None declared.

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