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Epidemiological patterns of animal bites in the Babol County, North of Iran

Saber Ghaffari-Fam[1], Seyed Reza Hosseini[2], Amin Daemi[3], Hassan Heydari[2], Rahim Malekzade[2], Erfan Ayubi[4], Hossein Ali Nikbakht[2*]

[1]*School of Nursing of Miandoab City, Urmia University of Medical Sciences, Urmia, Iran*

[2]*Social Determinants of Health Research Center, Faculty of Medicine, Babol University of Medical Sciences, Babol, Iran*

[3]*School of Health Management and Information Sciences, Iran University of Medical Sciences, Tehran, Iran*

[4]*Department of Epidemiology and Biostatistics, School of Public Health and Health Research Institute, Tehran University of Medical Sciences, Tehran, Iran*

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ABSTRACT

Objective: To describe the current situation of animal bites in the Babol County, North of Iran.

Methods: This was a cross-sectional study based on recently collected data of 3798 victims bitten (656 females and 3142 males) from 2010 to 2014 in the Health Center of Babol, Iran. The interest variables in the study included demographic variables, characteristics of animal, some of the time patterns, and some clinical patterns provided to victims.

Results: The average age of victims was (33.68 ± 17.23) years. The age group with the max proportion (for males, 32.1%; for females, 26.2%) of bites occurred in 18–30 years old group for males and 30–45 years for females. The ratio of male victims to female ones was 4.78. In terms of place of incident, 2502 (65.9%) cases of animal bites occurred in rural areas. Dogs and cats were the most dominant biters with 3340 (87.9%) and 395 (10.4%) bites, respectively. For the kinds of biters, 3643 (95.9%) were pets, 133 (3.5%) were strays and 22 (0.6%) were wild animals. Most of the lesions were on shoulder as well as upper organs (46.9%) and lower organs (41.0%), respectively.

Conclusions: Since the average age of the subjects with injuries on the head and upper organs was lower than that of victims with other organs injured and since that pet dogs were the major biter, structured monitoring programs that focus on specified target groups in collaboration with other organizations are essential to control the animal bites.

1. Introduction

Animal bites are the most common sources of rabies virus infection[1]. Millions of people are vaccinated against rabies virus all around the world every year. Due to the lack of the disease control in pets and wild animals in Iran, the risk of rabies is notable[2,3]. Animal bites have serious medical consequences including trauma, wound infection, exposure to rabies virus and social costs for the bitten individuals, and lead to thousands of deaths and injuries[4].

More than ten million people every year in different regions of the world are treated due to animal bites to prevent rabies[5]. So that, 96.5% of the economic losses caused by the rabies treatments have occurred in low- and middle-income countries which include approximately 560 million dollars[6]. Due to the lack of advanced care system for rabies, the actual number of victims is probably higher than reported number[7]. According to the World Health Organization, more than 2.5 billion people are at risk of the disease, and the disease has been reported in more than 100 countries[8].

The incidence rate of animal bites has increased in Iran in recent years[9]. In terms of animal bites epidemiology in Iran, like other regions, dogs are responsible for the majority of injuries[3].

*Corresponding author: Hossein Ali Nikbakht, MSc, Health Deputy, Babol University of Medical Sciences, Babol, Iran.
Tel: +98 11 32332878
E-mail: Ep.nikbakht@gmail.com

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Taking care of animal bite-related injuries can provide useful information for planning and evaluation of public health interventions[10]. Providing broad and detailed information about the epidemiological patterns, transmission dynamics of the disease in humans and animals is essential to the success of any control program in order to control animal bites by implementing modern modeling methods and strategies appropriate to each region. The aim of this study was to describe the epidemiology aspects of animal bites in the Babol County and then to suggest preventive and control actions.

2. Materials and methods

2.1. Methodology

This cross-sectional study was conducted from April 2010 to March 2014 in a health center of Babol County. Babol County is located in the Mazandaran Province with a humid climate covered by abundant forests and pastures.

The data were based on available records of animal bites at the health centers, so all bitten victims during the study period referred to health centers for the prevention, treatment and follow-up measures were extracted.

Bitten person is a person who, due to animal bite and their fear of rabies infection, was admitted to the rabies units.

The interest variables included demographic characteristics (age, gender, occupation), specifications of the living place of victims (urban or rural) and location characteristics when injuries occurred (urban or rural), animal types, species of animals (pet, stray and wild) and the animal's situation (dead or alive) after the bite, information relating to the organ of the body injury, wound extension, wound type, and the bites with/without protection of cloth, time patterns of injuries (hour, day, month, season, year), patterns of health cares provided to the patients, number of vaccination, vaccination status of tetanus vaccine, infusion of rabies serum, time length of lag (in days), and a previous history of animal bites.

The data in this study were analyzed by SPSS software, version 19. Descriptive characteristics were presented with mean value and SD, and in case of lack of normality, the median and interquartile range were used. The frequency (%) was used for qualitative variables. Furthermore, the age of the victims was categorized into five age groups: less than 7 years, 7–18 years, 18–40 years, 40–60 years and over 60 years.

2.2. Statistic analysis

The *Chi*-square test was used to assess a probable statistically significant difference between qualitative variables and Fisher's exact test was applied for limitations on the observed frequency. Independent-samples *t*-test was used to compare the equality of two mean values in qualitative variables and default equality of variances, and One-way ANOVA test was used to test the equality comparison of the averages among the ranks of qualitative variables. *P*-value less than 0.05 was considered as the significance level. The protocol for the present study was reviewed and approved by the Ethical Committee of Babol University of Medical Sciences.

3. Results

A total of 3 798 cases of animal bite occurred during the study period. The mean age of the victims was (33.68 ± 17.23) years, and the age of victims ranged from 2 to 90 years. There was a significant difference between the mean age of males [(33.01 ± 16.73) years] and females [(36.91 ± 19.14) years] ($P < 0.001$). The most common age groups involved in the bites for males and females were 18–30 years and 30–45 years, respectively (Table 1).

Table 1
Distribution of age groups in terms of gender of bitten victims referred to health centers of Babol County, Iran (2010-2014). *n*(%).

Age groups (years)	Male	Female	*P*
< 7	141 (4.5)	43 (6.6)	0.001
7–18	457 (14.5)	81 (12.3)	
18–30	1 009 (32.1)	132 (20.1)	
30–45	815 (25.9)	172 (26.2)	
45–60	514 (16.4)	161 (24.5)	
> 60	206 (6.6)	67 (10.2)	
Total	3 142	656	

Males comprised 3 142 (82.7%) cases of all victims; ratio of male to female was 4.78. In terms of the occupational distribution of victims, the most frequency belonged to the self-employed ones with number of 1 253 (33.0%), followed by students 546 (14.4%), housewives 484 (12.7%), and farmers 464 (12.2%), respectively.

In terms of living place, 1 358 (35.8%) cases were found from urban areas and 2 440 (64.2%) from rural areas. About bite location, 1 296 (34.1%) cases happened in urban areas and 2 502 (65.9%) in rural areas. In addition, 5.0% of urban residents were bitten in rural areas, while 0.2% of rural residents were bitten in urban areas.

The highest frequency of animal bites during the days of the week (according to Iranian week) was in Saturday (641, 16.9%) and lowest was in Friday (502, 13.2%). In terms of the distribution of animal bites over the years, the most animal bites happened in September (345, 9.1%), followed by April (339, 8.9%) and the least frequency was in March (262, 6.9%). The majority of bites happened between 6 a.m. to 12 a.m. and 12 a.m. to 6 p.m. (Figure 1). There was a significant relationship between the time of injury and animal activity, and more animal bites were coincided with daily activities of mankind ($P = 0.01$).

According to the distribution of site of body injury, the greatest frequency belonged to the shoulder and upper organs with 1 783 cases (46.9%), followed by lower extremity with 1 556 cases (41.0%) and the lowest proportion pertained to the head and neck with 76 cases (2.0%) and abdominal organs with 78 cases (2.1%).

A significant correlation was observed between age groups and the site of the body injury ($P < 0.001$). Based on the results of One-way ANOVA test, the average age of victims with head and neck injuries (25.72, SD = 21.02) was lower compared to that of the victims with injuries to lower extremities (33.79, SD = 16.45) and victims with injury to two or more organs (37.83, SD = 17.88) ($P < 0.001$) (Figure 2).

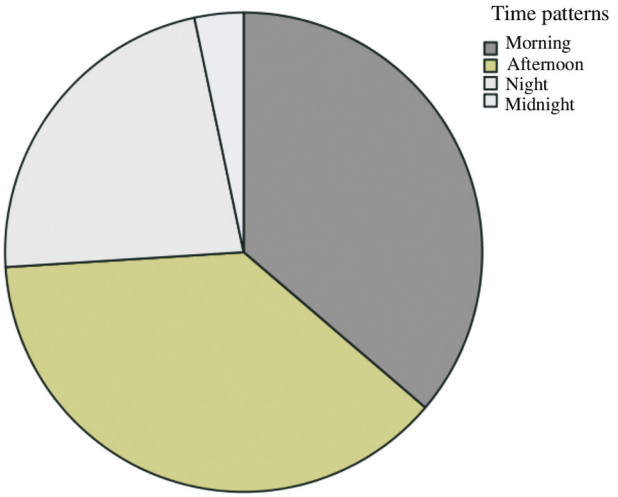

Figure 1. Comparison of the time of injury during a day among bitten victims referred to the health centers of Babol County, Iran (2010-2014).

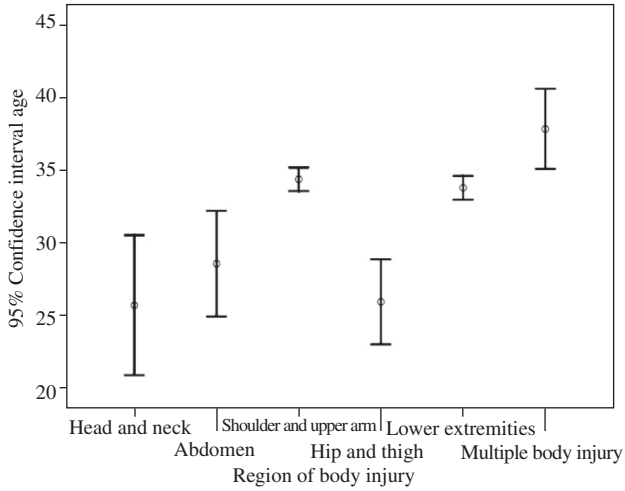

Figure 2. Comparison of the average age of victims in terms of the bitten organs referred to health centers of Babol County, Iran (2010-2014).

For the circumstances of the lesion that 3 579 cases (94.2%) had small lesions and 219 (5.8%) had large ones. A total of 2 600 cases (68.5%) of animal bites happened with the protective covers like cloths, and 1 198 cases (31.5%) had no special protection. Dogs and cats were the most common and dominant biters (Table 2). Also, in terms of biter's type, 3 643 (95.9%) were pets, 133 cases (3.5%) were strays and 22 cases (0.6%) were wild animals. The majority of wild animals in bitten cases were other animals (Table 2), so there was a significant difference between the biter's type and biting animal species ($P < 0.001$).

According to the data, 3 592 cases (94.6%) received rabies vaccine referred to health centers without delay, 125 (3.3%) with one day delay and 81 (2.1%) with two days or more. A total of 273 (7.2%) patients had a history of using serum. There was a significant difference between the gender groups and the time delay to receive rabies vaccine ($P = 0.019$). In terms of the ratio of time delay between urban and rural areas, most of the time lag occurred in victims who lived in rural places ($P = 0.006$). The longest time lag belonged to the victims bitten by pets ($P < 0.001$).

Table 2

Distribution of biter animals among victims referred to health centers in Babol County, Iran (2010-2014).

Biter type	Animal species	*n*(%)
Pet	Dog	3 340 (87.94)
	Cat	395 (10.40)
Strays	Mouse	2 (0.05)
	Sheep	6 (0.16)
	Monkey	9 (0.24)
	Pig	6 (0.16)
Wild animal	Wolf	4 (0.11)
	Fox	3 (0.08)
	Tiger	3 (0.08)
	Others	30 (0.79)

A total of 3 349 (88.2%) of the victims received three doses of rabies vaccine after they were bitten by animals and only 108 cases (2.8%) had the history of receiving five doses of rabies vaccine. A total of 1 928 (50.8%) cases received tetanus vaccine when they referred to a health center. Seventeen (0.4%) victims had the history of animal bites. In this study, the incidence of animal bites per hundred thousand population of Babol County, had the lowest range in 2010 (130 cases), with an increase reached to 195 cases in 2014 (Figure 3). The results of Cochran-Armitage test confirmed the increase of animal bites in Babol County ($P < 0.001$).

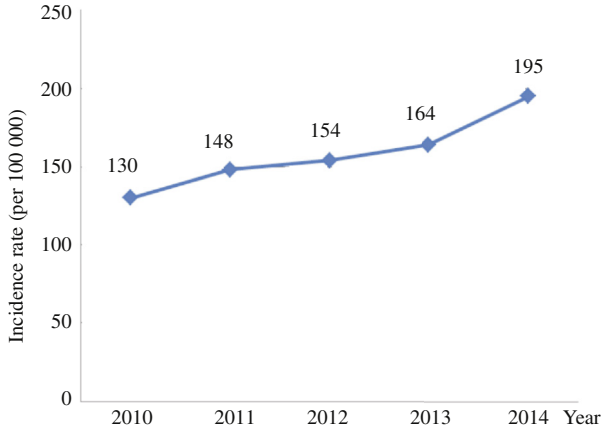

Figure 3. Trends in the incidence rate of animal bite cases per hundred thousand population of Babol County, Iran (2010-2014).

4. Discussion

In this study, the incidence rate of animal bites in Babol County per hundred thousand population had an increasing trend from 130 in 2010 to 195 in 2014 that was alike the national average[11]. In the Mazandaran Province, due to the environmental conditions of the region, about 20 000 animal bites were reported during the years 2001-2005. The highest incidence of animal bites has been reported in Behshahr County, Mazandaran Province, with 302 animal bites per hundred thousand population[3].

In a study conducted in Rafsanjan, Kerman Province, the incidence of animal bites in 2003, 2004, 2005 were estimated to be 180, 195 and 241 cases per hundred thousand population, respectively[2]. In this study and other studies, the increasing trend in animal bites can be attributed to increasing awareness

of people to refer to rabies prevention centers or may be due to an actual increase, which should be investigated in other studies specifically.

In our study, the proportion of male victims was 82.7% and the ratio of male to female was 4.78. In a study in Tehran, Iran, 79.16% of bites occurred for men[12]. In another study in Mazandaran Province (North Iran), the frequency of bites in men was 79.62%[3]. The similar proportion in south of India was 72.4% for males[13]. It seems that the higher frequency of injuries in males is associated with their greater presence in the open environment due to their occupational condition and non-occupational activities and more exposure as well as their courage.

According to the data of this present study, the mean age of the victims was 33.68 years (SD = 17.23). The most frequent age group in victims belonged to the age group of 18–30 years for males and 30–45 years for females. The study of Sheikholeslami *et al.* in Rafsanjan City, Kerman, Iran reported the average age of the bitten victims as 27 years old with a standard deviation of 17.1[2]. Eslamifar *et al.* reported the most biting group aged 20–29 with 30.1% in Tehran (capital of Iran)[12]. About 47.5% of victims were children aged 2–18 years[13]. Kassiri in a study in Shoush County, Ahvaz, Iran, showed that the maximum rate had happened in the age group 10–20 years with 33.4% frequency[14]. Most cases of animal bites in other studies in Iran were in age range of 10–19 years and 20–29 years, respectively[15,16]. It seems that the high frequency of animal bites in adolescents and young adults is due to close contact with animals and stimulating aggressive modes in animals.

According to the findings of this study, farmers had the lowest proportion of animal bites (12.2%), while in other studies, that farmers comprised a notably bigger proportion of animal bites mainly due to more exposure to the animals[17,18]. The fact that in this study, farmers comprised a small proportion of the victims may be, to some extent, due to the touristy nature of the study site. Numerous people come to the area for vacation but they usually are unfamiliar with the animals and do not know how to behave with them. As a result, they become bitten, especially by the dogs.

In the present study, in terms of the geographical distribution of animal bites, 65.9% of the bites occurred in rural areas. These results are consistent with other studies conducted in Iran[19]. It seems that the high incidence of animal bites in rural region is because of the agricultural and animal husbandry occupation of these people which puts them in more exposure to animals. We found dogs and cats as the most common dominant biters. In other studies conducted in Iran, dogs were responsible for the majority of animal bites[2,3,12,20]. A potential reason for this finding may be the key role of the dogs in the rural life and the closeness of human beings with the dogs in such places. In terms of the biters species, 95.9% were pets. The majority of wild animals were wolves, foxes, tigers and other animals (Table 2). Given that most of the animal bites have happened by pet animals, the need for appropriate behavioral skills training in dealing with these animals is important for the group exposed to risk. The vaccination of pets, especially dogs, is emphasized.

We observed that the greatest injuries belonged to the shoulder and upper organs (46.9%), and lower organs (41.0%). Animal attacks to humans result in the hundreds of injuries and millions of deaths worldwide[21]. In a study in Tabas County, Yazd Province, Iran, the organ in the body injury with the highest incidence was injuries to upper organs (55.6%)[22]. In a study in Ethiopia, the highest injuries belonged to the legs[23]. Most studies reported the lower organs as the most bitten organs which were inconsistent with our results[20]. Individuals often face with dogs in the standing position and then they are bitten on legs, while individuals expose to cat scratches usually when they are sitting. Even if you face an aggressive cat in the standing position, due to its biological behaviors and body structure, it tends to jump on you and scratch the upper extremity or the head.

In present study, in 94.2% of the bites, the lesions were small. Moini *et al.* reported that injuries caused by animal bites were the rare and less common causes of trauma in Iran (0.2%)[18]. In accordance with the results of other studies, the majority of animal bites lead to mild trauma[24].

According to our data, majority of the victims referred to health centers without delay, in other words, in the initial hours after the bite. Affective variables in the delay time for receiving care included sex, living place, and animal type. In a study by Riahi *et al.* in Tabas County, the most influential factors in time lag included: age, incident hour, lower organ injury, previous history of vaccination, having been recommended for the initial treatment of wounds and animal types[22]. Shortages in public transportation in the rural areas and lack of knowledge about risks of animal bites might be potential reasons behind this.

In our study, majority of the victims received three doses of rabies vaccine and only 2.8% of them received five doses. In a study in China, at least 62.5% of patients have not received proper treatments in accordance with standard protocols for the treatment of wounds; 92% of the patients received complete vaccination after exposure and 91.25% had not received rabies immunoglobulin[25].

There is a need to gather accurate information about epidemiological patterns of any health problem for each community to develop preventive and control measures. Because of the increasing trend of animal bites, and also of the majority of bites occurred by dogs especially pets, it is recommended to create barriers to prevent human contact with dogs especially domestic animals, to train and increase awareness of people of the risk of animal bites and the probability of infection by rabies virus if they do not go to health centers for receiving rabies vaccine.

The main limitation of this study is due to its retrospective design in which incomplete records of the victims may cause misclassification or the low quality of recorded data may lead to classification bias.

Conflict of interest statement

The authors report no conflict of interest.

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