

ANIMAL-RELATED INJURIES: EPIDEMIOLOGICAL AND METEOROLOGICAL FEATURES

Mucahit Emet¹, Nazim Ercument Beyhun², Zahide Kosan², Sahin Aslan¹,
Mustafa Uzkeser¹, Zeynep Gokcen Cakir¹

¹Ataturk University Medical Faculty, Emergency Department, Erzurum, Turkey

²Ataturk University Medical Faculty, Department of Public Health, Erzurum, Turkey

Emet M, Beyhun NE, Kosan Z, Aslan S, Uzkeser M, Cakir ZG: Animal-related injuries: epidemiological and meteorological features. *Ann Agric Environ Med* 2009, **16**, 87–92.

Abstract: This is a retrospective and registry-based descriptive study including animal-related injuries represented by the most crowded Emergency Department (ED) in Eastern Turkey over a period of two years. Animal-related injuries were 0.2% of all ED admittances; dominant in males and were high in summer. 68% of the subjects were exposed to mammals. Most prominent injuries were dog bites (30%), horse (22%) and livestock-related injuries (12%). Hospitalization was significantly higher in mammalian animal injuries compared to non-mammalian injuries. The highest hospitalization rate was measured for equine-related injuries (15%). In our bite series, dogs were the primary source (69%) while horse-bites (17%) took the second place and they were more than two fold more when compared with cats (7.5%). Dog bites were prominent in children, thus both parents and children should be educated. Insect and snake-related injuries were both low in number and relatively silent in prognosis. Highest temperatures on site were determined for tick-bites, unspecified insect stings and bee stings, respectively. The highest humidity was determined for dog-bites, cat-bites and scorpion stings, respectively. Non-mammalian and sting injuries had higher temperature and lower humidity measurements compared to mammalian and bite injuries. Geographical and meteorological factors may directly affect descriptive epidemiology of animal-related injuries.

Address for correspondence: Mücahit Emet, Assistant Professor, Emergency Physician, Atatürk Üniversitesi, İlk ve acil Yardım AD, Aziziye Hastanesi Posta Kodu: 25200 Erzurum/Türkiye. E-mail: mucahitemet@gmail.com

Key words: animal-related injuries, epidemiology, meteorology, humidity, temperature, bite, sting.

INTRODUCTION

The threat of animal attacks on people is still a huge medico-social problem as these attacks result in millions of injuries and thousands of deaths all over the world [21]. In Turkey between 1995–2004, 240 animal-bite related deaths occurred and a total of 39,511 patients needed hospitalization in state hospitals [31]. An average of 177 fatalities per year was recorded due to animal-related fatalities in the United States of America (USA) [12]. Besides, the medical and financial costs from both fatal and non-fatal animal encounters have a significant impact on public health [12]. Surveillance of animal-related injuries could provide

useful information for planning and evaluating public health interventions as well as Emergency Department (ED) staff planning.

One of the characteristic of animal-related injuries is their variation due to geographic and climatic features [20]. The study site (Erzurum Province) is situated in North-Eastern Anatolia at a 2,000 meters altitude, where extreme and rigorous climate conditions rule the region. Agriculture is the unique primary industry in the study area, and animals are one of the main causes of injuries in the farming industry [6].

The aim of this survey was to explore the main descriptive epidemiology of animal-related injuries represented



by an ED. We also examined the epidemiology of animal-related injuries by means of regional meteorological aspects.

METHODS

Study type. This is a retrospective descriptive review gathered from the trauma registry books of a State Hospital, a level II trauma centre located in Erzurum Province, Eastern Turkey. It summarizes animal-related injuries that have been presented to an ED between 1 January 2005–31 December 2006 (two years).

Study site and subjects. The subjects were patients living in Erzurum Province city centre and its affiliated rural districts who suffered from animal-related injuries and presented to the ED of Erzurum State Hospital in Eastern Turkey. Patients who were living in other provinces were excluded. Erzurum is the most crowded province with a population of approximately 400,000, and a city centre at an altitude of 1,850–2,000 meters above sea level. During the study period, more than 350,000 admittances occurred in the ED (2005 and 2006). This ED was the most crowded in Eastern Turkey which is the least developed region of the country.

Data Collection and Management. The data was collected from computer-based patient registries and patient files by emergency specialists. The data was recorded to a structured patient chart which consisted of patients' gender, age, source of injury (dog, horse, livestock, bee, scorpion,

bug, snake, cat, tick, etc), month, prognosis (hospitalized, ambulatory treatment, transferred to another facility), meteorological measurements (temperature, humidity). The data presented in this study deal with injuries caused directly by animals, while those caused indirectly, e.g. road accidents, are not included. Human bites were also excluded. Details of outcomes, such as allergic reactions, wound infection, and zoonotic and vector-borne diseases (e.g., rabies, Crimean Congo haemorrhagic fever, and Lyme disease) were not included in the study. "Unspecified insect-bites" included spider, vespids, ants, mosquitoes and unknown bug bites. Livestock included bulls, cows, cattle, goats and sheep. The subjects with missing data (incomplete chart file) have been excluded.

Determination of meteorological measurements. The mean daily temperature ($^{\circ}\text{C}$) and humidity (g/m^3) at the place of injury (city centre and rural districts) was determined from the registered measurements of the Regional Directorate of Meteorology, Erzurum, Turkey which can provide mean temperature and mean humidity for each day. The variations of the temperatures within city centre and within hours in a day were underestimated.

Statistics. The statistics of the data were achieved by SPSS 13.0 (SPSS Inc., Chicago, IL, USA). The significance between the sources of animal-related injuries, age groups and gender was tested by Pearson chi-square test. The differences in temperature and humidity between types of animal injuries were analyzed via Independent Samples t-test. P value less than 0.05 was accepted as significant.

Table 1. Prognosis of animal-related injuries according to animal species and mechanism of injury, including patient's age and gender.

Animal	Mechanism of injury	Hospitalization n (%)	Ambulatory treatment n (%)	All animal related injuries n (%)	Age <18 n (%)	Male gender n (%)
Dog	Bite	2 (0.7)	267 (97.1)	275 (29.9)	162 (58.9)	219 (79.6)
Horse	Fall, step on/kick, bite	30 (15.0)	127 (63.5)	200 (21.7)	86 (43.0)	172 (86.0)
Livestock	Butt, step on/kick	8 (7.1)	80 (73.4)	113 (12.3)	31 (27.4)	78 (69.0)
Bee	Sting	0 (0.0)	81 (96.4)	84 (9.1)	42 (50.0)	53 (63.1)
Scorpion	Sting	7 (9.3)	53 (70.7)	75 (8.1)	27 (36.0)	43 (57.3)
Unspecified insect	Sting	1 (1.7)	46 (78.0)	59 (6.4)	18 (30.5)	42 (71.2)
Snake	Sting	4 (8.5)	18 (38.3)	47 (5.1)	16 (34.0)	26 (55.3)
Cat	Bite	0 (0.0)	30 (100.0)	30 (3.3)	11 (36.7)	17 (56.7)
Tick	Bite	0 (0.0)	13 (56.5)	23 (2.5)	11 (47.8)	14 (60.9)
Other (rat, donkey, wolf, bear, bird)	Bite, fall, kick, assault	0 (0.0)	14 (93.3)	15 (1.6)	5 (33.3)	10 (66.7)



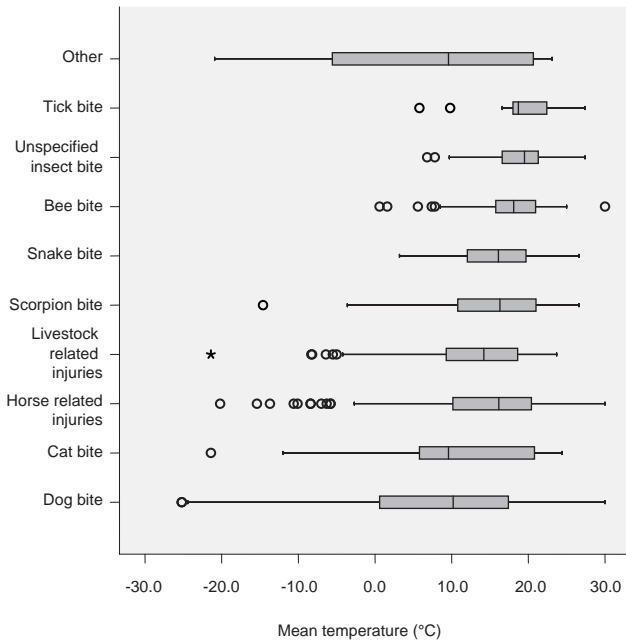


Figure 1. Mean daily temperature on site according to source of animal-related injuries.

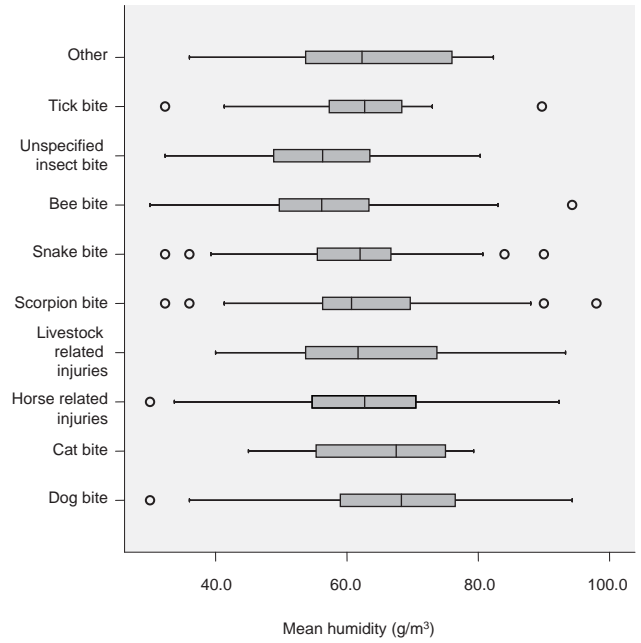


Figure 2. Mean daily humidity on site according to source of animal-related injuries.

Ethics. Official permission for the use of meteorological measurements was obtained from the Regional Directorate of Meteorology, Erzurum, Turkey; and authorization for the study was provided by the Ethical Committee of the State Hospital.

RESULTS

During a two-year period, a total of 921 animal-related injuries were presented at an ED (921/315,531, 0.2% of all admittances to ED). Mean age of exposed subjects were 26.1 ± 19.9 years (range = 1–85) and 73.2% (n = 674) were males. The 44.4% (n = 409) were children. The injuries were dominant in August (n = 171, 18.5%) and July (n = 152, 16.5%). The prognoses of all animal-related injuries were relatively silent. Of the subjects, 79.6% (n = 735) were discharged. The hospitalization rate was 5.6% (n = 52). No injury caused mortality in the ED. Mean daily temperature and humidity on site were $12.8 \pm 9.6^\circ\text{C}$ and (range between -25.2°C and 30.0°C) and $63.3 \pm 12.4 \text{ g/m}^3$ (range = 30–98 g/m^3), respectively.

Prognosis of animal-related injuries according to animal species and mechanism of injury, including patient’s age and gender is presented in Table 1. Of 921 animal-related injuries, the most prominent injuries were dog-bites (29.9%, n = 275), horse-related injuries (21.7%, n = 200) and livestock-related injuries (12.3%, n = 113). The highest hospitalization rate was measured for horse-related injuries (15%, n = 30). Within horse-related injuries, 60.5% (n = 121), 34.0% (n = 68) and 5.5% (n = 11) were falls, kicks and bites, respectively; and the highest hospitalization rate was 18.2% (n = 22) for falling from a horse.

Dog-bites (58.9% vs. 41.1%, Pearson $\chi^2 = 32.5$ $p < 0.001$) were greater in children compared to adults, whereas livestock injuries were greater in adults than in children (72.6% vs. 27.4%, Pearson $\chi^2 = 15.0$, $p < 0.001$). All other sources of animal-related injuries were dominant in adults, but the differences were not significant ($p > 0.05$ for all). All sources of animal-related injuries were dominant in the male gender. The difference was significant for dog-bites, livestock and horse-related injuries, unspecified insect stings and tick-bites (Pearson χ^2 , $p < 0.05$ for all).

Mean daily temperature and humidity on site according to type of animal-related injuries are shown at Figures 1 and 2, respectively. The highest temperatures ($^\circ\text{C}$) on site were determined for tick-bites (19.3 ± 4.7), unspecified insect stings (18.6 ± 4.4) and bee stings (17.5 ± 5.2), respectively. The highest humidity (g/m^3) on site were determined for dog-bites (67.4 ± 12.2), cat-bites (65.1 ± 10.4) and scorpion stings (63.0 ± 12.6), respectively.

All sources of animal-related injuries were determined to be high in summer. 91.3% (n = 21) of tick-bites presented to the ED in summer; but dog-bites were also seen

Table 2. Distribution of bite and sting injuries by animal species.

Bites	n	%	Stings	n	%
Dogs	275	68.9	Bees	84	31.7
Equine	68	17	Scorpions	75	28.3
Cats	30	7.5	Unspecified insects	59	22.3
Ticks	23	5.8	Snakes	47	17.7
Others	3	0.8			



Table 3. Prognosis, age, gender and meteorological features according to type of animal species (mammalian/non-mammalian) and mechanism of injury.

	Mammalian	Non-mammalian	Bite*	Sting*
All animal-related injuries n (%)	625 (67.9)	296 (32.1)	399 (43.3)	265 (28.7)
Hospitalization n (%)	40 (6.4)	12 (4.1)	9 (2.3)	12 (4.5)
Ambulatory treatment n (%)	514 (82.2)	219 (74.0)	362 (90.7)	198 (74.7)
Male gender n (%)	492 (78.7)	182 (61.5)	310 (77.7)	164 (61.9)
Age <18 n (%)	292 (46.7)	117 (39.5)	220 (55.1)	103 (38.9)
Temperature (°C – mean ± SD)	10.8 ± 10.3	16.8 ± 6.2	9.7 ± 11.1	16.8 ± 5.9
Humidity (g/m ³ – mean ± SD)	64.9 ± 12.3	59.7 ± 11.9	66.3 ± 12.1	59.7 ± 11.7

*Bites: dog, horse, donkey, cat, tick. Stings: bee, scorpion, bug, snake.

during winter at a considerable proportion (18.9%, n = 52). Scorpion, snake, bee, unspecified insect stings and tick-bites were not detected during winter.

Prognosis, age, gender and meteorological features according to type of animal species (mammalian vs. non-mammalian) and mechanism of injury (bite vs. sting) are shown in Table 3. Most of the subjects were exposed to mammalian (67.9%, n = 625) animals. Hospitalization was significantly higher in mammalian injuries compared to non-mammalian injuries (6.4 vs. 4.1%, Pearson $\chi^2 = 1.6$, $p < 0.05$). Mean daily temperature was significantly higher (16.8 ± 6.2 vs. 10.8 ± 10.3°C, $t = -10.7$, $p < 0.001$) and mean daily humidity was significantly lower (59.7 ± 11.9 vs. 64.9 ± 12.3 g/m³, $t = 6.0$, $p < 0.001$) in non-mammalian animal injuries compared to mammalian injuries. Distribution of bite and sting injuries through animal species are given in Table 2. Ambulatory treatment was significantly higher for bites compared to stings (Pearson $\chi^2 = 29.7$, $p > 0.001$) whereas hospitalization rate did not differ (Pearson $\chi^2 = 1.9$, $p > 0.05$). Children were exposed to bites much more than stings (Pearson $\chi^2 = 16.2$, $p > 0.001$). Mean daily temperature for stinging was significantly higher than that for bites (16.8 ± 5.9 vs. 9.7 ± 11.1°C, $t = -10.6$, $p < 0.001$).

DISCUSSION

Animal related injuries are not similar throughout countries by means of characteristics of animals involved and types of injuries sustained. These dissimilarities are likely as a result of the incomparable rural habitat of each country [20]. The most prominent injuries in our region were due to mammals as dogs (30%), horses (22%) and livestock (12%); while in Poland, common sources include insects (49%), dogs (15%) and cats (13.5%) [21]; and in Italy, the prevalence of the causative agents were insects (53%), mammals (31%) and marine fauna (7%) [17].

Within all admittances to EDs, the proportion of animal-related injuries may differ between countries: 2.7, 2.6 and 1.0 for Italy, Poland and USA, respectively [16, 20,

28]. We calculated this ratio as relatively low (0.2%) as Steele *et al.* found in a prospective multicentric study of mammalian animal exposures (0.2%) [29]. Our study only involved patients injured severely enough to ensure admission, excluding those confirmed dead in the field. Thus, a large number of injured people possibly never came for medical attention. Statistics on animal bites are poor as most bite injuries are minor and self-treated [27]. The data are often associated with patients seen at hospitals, thereby predominantly excluding those that are insignificant [18].

Many studies indicate that animal-related injuries are important risk factor for the farming population – adults and children [1, 15] and are one of the three main external causes of injuries [13, 22]. Animals cause a considerable percentage of the injuries to children and male, injured as seen both in our study and other studies on the topic [21, 30]. Hospitalization due to animal-related injuries worldwide is between 0.3–11.6% [15, 18, 21, 23]. Our hospitalization rate (5.6%) was also in a comparable range.

In various studies, dogs were the primary animal species implicated in bite injuries with a range 63–80% [18, 27, 29]. The second cause of bite injuries differs throughout countries. In Switzerland, Spain and the USA, the second bite source was cats with a range of 5–25% [10, 18, 23, 28]. In the Middle Anatolia in our country, Tuncali *et al.* found the bite series to be dogs (76%), cats (22%), followed by a small percentage (2%) of other animal bites such as; horses, donkeys, cows and rats [28]. In our bite series, dogs were the primary source (69%) as expected. Interestingly, horse-bites (17%) took the second place and were more than twice as many when compared with cat-bites (7.5%) in our results. Domesticated animals at home may differ between societies; therefore local traditions may affect the epidemiology of animal-related injuries. In this region, we observed that local residents do not like domesticated cats and dogs at home, which may be due to economical and religious reasons. It was argued by many researchers that males were more often victims of dog-bites and females of cat-bites [5, 15, 23, 24]. However in our study, male predominance was detected in both animal bites.

Compared with adults, children were more likely to be bitten by dogs and were vulnerable to dog attacks [29]. Higher dog attacks are thought to be attributable to their size and the proximity of their face to the dog's mouth, and attacks are generally related to interaction with the dog (possibly provocative) before the attack [15, 25, 26]. Child predominance was also observed in our dog-bite results (59%), and also influenced the finding that children were exposed to bites much more than stings (55% vs. 39%, respectively). Such injuries express a preventable public health problem that may be diminished by public education about responsible pet ownership, and regulations regarding animal control [1, 15]. Both adults and children should be taught to refrain from behaviours likely to provoke bites and to follow suggestions for the prevention of canine aggression [14, 18, 33]. Hospitalization rates due to animal bites are between 0.8–11.6% [15, 18], most of whom were men and under 18 years of age [18, 23]. We also found a comparable hospitalization rate (2%), and male (78%) and child (55%) predominance in animal bites.

Extra caution should be given to livestock and horse-related injuries due to their size, speed, and independent nature. While livestock injuries were mostly related to agricultural occupations [4], equine-related trauma might occur due both to agricultural and sportive activities. As rodeo riding is a popular sport in Texas; we have a traditional Turkish sport named 'Jereed' (javelin throwing on horseback) in this region that make riders prone to injuries. Criddle examined the traumas related to livestock (horse, bull, goat) in patients in Texas. For horse-related injuries, falling or being thrown was the most common cause of injury (70%). Being stepped on or kicked also occurred regularly (24%). 12% were crushed, and none were gored [4]. Within horse related injuries in our study, 60%, 34% and 5.5% were falls, step on/kicks and bites, respectively. These results show that equine-related traumas not only happen through riding; close proximity to these large, powerful, and sometimes unpredictable animals can be very dangerous as a horse can kick with up to one ton of force [11]. As most serious injuries are caused by large animals, such as horses and cows [20, 21], all researchers concur about using helmets, steel-toed boots, gloves, wide brimmed hats, and denim for people who are close to these kinds of animals [2, 5, 4]. The highest hospitalization rate was measured for horse-related injuries (15%), as in two other studies [7, 21]. The highest was especially for falling from a horse (18%). As a unique result, we also demonstrated that hospitalization was significantly higher in mammalian animal injuries compared to non-mammalian injuries (6% vs. 4%). This was perhaps because of the higher rate of large mammals in our source.

Insect stings are the vast majority of animal-related injuries treated at EDs worldwide [21, 23]. Bee and spider bites follow this [23]. Unspecified insect-bites were found to have a higher proportion among children than adults, and the reason was ascribed to the fact that parents may

not have witnessed the bite or sting to their child, and children may be too young to exactly identify the cause [23]. However, according to our results, unspecified insect-bites took only a 30% ratio among patients under 18 years old in our study. Injuries resulting from insects and arachnids cause hospitalizations, and even a considerable amount of deaths in warmer climate countries such as the USA [20, 23]; but in hard and cold climates the prognoses are usually silent, such as in Erzurum (hospitalization rate 4% in our study) or in Alaska (no fatal injury) [20]. This is also true for snake-bites, as our hospitalization rate is too low (8.5%) when compared with the USA (58%) [23].

Tick-bites in the study catchment area have got extra importance since Crimean Congo haemorrhagic fever (CCHF) is a tick-borne disease, and Turkey is an endemic country. Between 2002–2007, 1,820 subjects were diagnosed as CCHF, with a fatality rate of 5%. In the study site during 2007, there were 57 CCHF and one death. Most cases were diagnosed during summer [19]. Most authors claim that the danger of being bitten by ticks increases in spring and autumn when the behavioural activity of these arthropods is the greatest [9]. However, our study demonstrated that accretion is in the summer months in our region, in line with the distribution of CCHF cases in the region. After the seasonal fluctuations having been eliminated, it was shown that air temperature and humidity play a role on active tick numbers [9, 32]. Žáková and colleagues later found that the temperature range from 15–25°C and humidity from 50–70% were obtained as the most suitable conditions for the tick activity in the examined area. Our findings clearly espoused these findings by having almost the same measurements (Figures 1 and 2) [34]. This may be due to the climatic specialities of Erzurum, and proof of the effect of local climatic conditions on the epidemiology of animal-related injuries.

Overall, bites and stings were more frequent in the summer months, which is concordant with other studies [18, 23, 30]. It was shown that humidity and temperature had the greatest effect on the mood and violent behaviour in humans [8, 16]. However, we could not find any observation about whether or not the weather effects the frequency of mammalian attacks. Thus, in order to discuss the findings 'the highest humidity on site were determined for dog, cat and scorpion-bites', and the 'mean daily humidity was significantly lower in non-mammalian animal injuries compared to mammalian injuries', we need further investigations. However, this study may provide a baseline and descriptive knowledge in the field of interest.

The highest temperatures were determined for non-mammalian animal-bites (for tick, non-specific insect and bee bites, respectively), and mean daily temperature for stings being significantly higher than bites can easily be explained by knowing the fact of the existence that these creatures and their activity peaks during summer.

The basic limitation was that the analyzed group of patients was treated at a single medical centre. For that reason, the results may not be adequate for the whole

population of the Erzurum Region. Another limitation is that the mean daily temperature and humidity on the place of injury was determined, instead of taking hourly measurements. This may affect the results, especially as the daylight and evening measurements may differ.

Our study is the unique one for animal-related injuries and describes the epidemiology and its meteorological determinants in Turkey. It therefore provides a comparable data to the other parts of the world in the field of animal-related injuries.

CONCLUSIONS

Dog, horse and livestock-related injuries were the main reasons for animal-related injuries in the region. Medical personnel should have extra knowledge for the approach and complications of these injuries. Children were more vulnerable to dog attacks compared to adults; thus children should be taught to refrain from behaviours likely to provoke dogs. Victims injured by large mammals should be assumed to have high energy trauma until proven otherwise due to high morbidity. Insect and snake-related injuries were both poor in number and relatively silent in prognosis in the region. Non-mammalian and sting injuries have higher temperature and lower humidity measurements, compared to mammalian and bite injuries. We have provided baseline data about specified animal-related injuries and their relations with meteorological parameters. The answer to "Why?" needs further evaluation.

Acknowledgements

The authors are grateful to the head physician of the Numune State Hospital Selcuk Bozhalil.

REFERENCES

- Ashby K: Dog Bites. Victorian injury surveillance system. *Hazard* 1996, **26**, 7-13.
- Chitnavis J, Gibbons C, Hirigoyen M, Lloyd Parry J, Simpson A: Accidents with horses: What has changed in 20 years? *Injury* 1996, **27**, 103-105.
- Cogbill T, Steenlage E, Landercasper J, Strutt P: Death and disability from agricultural injuries in Wisconsin: a 12-year experience with 739 patients. *J Trauma* 1991, **31**, 1632-1637.
- Criddle LM: Livestock Trauma in Central Texas: Cowboys, Ranchers, and Dudes. *J Emerg Nurs* 2001, **27**, 132-140.
- Goldstein EJC: Bite wounds and infection. *Clin Infect Dis* 1992, **14**, 633-640.
- Governership of Erzurum Province: <http://www.erzurum.gov.tr/-Erzurum/Web/Gozlem.aspx?sayfaNo=10>. Accessed: 27 May 2008.
- Hobbs G, Yealy D, Rivas J: Equestrian injuries: a five-year review. *J Emerg Med* 1994, **12**, 143-145.
- Howarth E, Hoffman MS: A multidimensional approach to the relationship between mood and weather. *Br J Psychol* 1984, **75(Pt 1)**, 15-23.
- Kiewra D, Sobczyński M: Biometrical analysis of the common tick, *Ixodes ricinus*, in the Slezka Massif (Lower Silesia, Poland). *J Vector Ecol* 2006, **31(2)**, 239-244.
- Knobel Freud H, López Colomé JL, Serrano Sáinz C, Hernández Vidal P: Animal bites. Study of 606 cases. *Rev Clin Esp* 1997, **197(8)**, 560-563 (in Spanish).
- Kriss R, Kriss V: Equine-related neurosurgical trauma: a prospective series of 30 patients. *J Trauma* 1997, **43**, 97-99.
- Langley RL: Animal-related fatalities in the United States-an update. *Wilderness Environ Med* 2005, **16(2)**, 67-74.
- Lewandowski B, Szymanska J: Agriculture-related severe craniofacial injuries in rural children and adolescents. *Ann Agric Environ Med* 2008, **15**, 59-62.
- Lockwood R: Dog-bite-related fatalities – United States, 1995-1996. *MMWR* 1997, **16**, 163-167.
- MacBean CE, Taylor DM, Ashby K: Animal and human bite injuries in Victoria, 1998–2004. *Med J Aust* 2007, **186**, 38-40.
- Maes M, De Meyer F, Thompson P, Peeters D, Cosyns P: Synchronized annual rhythms in violent suicide rate, ambient temperature and the light-dark span. *Acta Psychiatr Scand* 1994, **90(5)**, 391-396.
- Massari M, Masini L: Relationships among injuries treated in an emergency department that are caused by different kinds of animals: epidemiological features. *Eur J Emerg Med* 2006, **13(3)**, 160-164.
- Matter HC, Sentinella Arbeitsgemeinschaft: The Epidemiology of bite and scratch injuries by vertebrate animals in Switzerland. *Eur J Epidemiol* 1998, **14(5)**, 483-490.
- Ministry of Health 2008: Turkey. <http://www.kirim-kongo.saglik.gov.tr/G3.doc>. Accessed: 30 April 2008.
- Mode NA, Hackett EJ, Conway GA: Unique Occupational Hazards of Alaska: Animal-Related Injuries. *Wilderness Environ Med* 2005, **16**, 185-191.
- Nogalski A, Jankiewicz L, Cwik G, Karski J, Matuszewski Ł: Animal related injuries treated at the Department of Trauma and Emergency Medicine, Medical University of Lublin. *Ann Agric Environ Med* 2007, **14**, 57-61.
- Nogalski A, Lübek T, Sompör J, Karski J: Agriculture and forestry work-related injuries among farmers admitted to an Emergency Department. *Ann Agric Environ Med* 2007, **14**, 253-258.
- O'Neil ME, Mack KA, Gilchrist J: Epidemiology of Non-Canine Bite and Sting Injuries Treated in U.S. Emergency Departments, 2001–2004. *Public Health Reports* 2007, **122(6)**, 764-775.
- Ostanello F, Gherardi A, Caprioli A, La Placa L, Passini A, Properi S: Incidence of injuries caused by dogs and cats treated in emergency departments in a major Italian city. *Emerg Med J* 2005, **22**, 260-262.
- Ozanne-Smith J, Ashby K, Stathakis VZ: Dog bite and injury prevention – analysis, critical review, and research agenda. *Inj Prev* 2001, **7**, 321-326.
- Patrick GR, O'Rourke KM: Dog and cat bites: epidemiologic analyses suggest different prevention strategies. *Public Health Rep* 1998, **113**, 252-257.
- Sinclair CL, Zhou C: Descriptive epidemiology of animal bites in Indiana, 1990-1992 – A rationale for intervention. *Public Health Rep* 1995, **110**, 64-67.
- Spence G: A review of animal bites in Delaware – 1989 to 1990. *Del Med J* 1990, **62**, 1425-1433.
- Steele MT, Ma OJ, Nakase J, Moran GJ, Mower WR, Ong S, Krishnadasan A, Talan DA; Emergency ID NET Study Group: Epidemiology of animal exposures presenting to emergency departments. *Acad Emerg Med* 2007, **14(5)**, 398-403.
- Tuncalı D, Bingül F, Terzioğlu A, Aslan G: Animal bites. *Saudi Med J* 2005, **26(5)**, 772-776.
- Turkish Statistical Institute: Health Statistics. Data according to reason of diseases. available at http://www.tuik.gov.tr/VeriBilgi.do?tb_id=6&ust_id=1. Accessed: 3 June 2008.
- Vail SG, Smith G: Air temperature and relative humidity effects on behavioral activity of blacklegged tick (Acari: Ixodidae) nymphs in New Jersey. *J Med Entomol* 1998, **35**, 1025-1028.
- Wright JC: Canine aggression toward people. Bite scenarios and prevention. *Vet Clin North Am Small Anim* 1991, **21**, 299-314.
- Žákovská A, Netušil J, Martiníková H: Influence of environmental factors on the occurrence of *Ixodes ricinus* ticks in the urban locality of Brno – Pisárky, Czech Republic. *J Vector Ecology* 2007, **32(1)**, 29-33.

