The prevalence of rabies and animal bites during 1994 to 2003 in Kerman province, southeast of Iran

Rezaeinasab, M.[1]; Rad, I.[2]; Bahonar, A. R.[3]; Rashidi, H.[4]; Fayaz, A.[5]; Simani, S.[5]; Haghdoost, A. A.[6]; Rad, F.[7] and Rad, M. A.[8*]

[1]Department of Surgery, Faculty of Medicine, University of Medical Sciences and Health Services of Rafsanjan, Rafsanjan, Iran; [2]Graduated from Faculty of Sciences, University of Tehran and MSc student in National Institute of Genetic Engineering and Biotechnology, Tehran, Iran; [3]Department of Epidemiology, Faculty of Veterinary Medicine, University of Tehran, Tehran, Iran; [4]Kerman Veterinary Organization, Kerman, Iran; [5]WHO Collaborating Center for Reference and Research on Rabies, Pasteur Institute of Iran, Tehran, Iran; [6]Department of Social Medicine and Epidemiology, Faculty of Medicine, University of Medical Sciences of Kerman, Kerman, Iran; [7]Graduated from Faculty of Civil Engineering, University of Tehran, Tehran, Iran and academic member of Faculty of Engineering, Rafsanjan Vali-E-Asr University (RVU), Rafsanjan, Iran; [8]Department of Clinical Sciences, Faculty of Veterinary Medicine, University of Tehran, Tehran, Iran

[*]**Correspondence:** M. A. Rad, Department of Clinical Sciences, Faculty of Veterinary Medicine, University of Tehran, Tehran, Iran. E-mail: marad@ut.ac.ir

(Received 18 Feb 2006; revised version 17 Sep 2006; accepted 11 Nov 2006)

Summary

To find the prevalence of domestic and wild animal bites in general, and that of rabies disease in human, in particular in Kerman province, southeastern Iran, a retrospective study was conducted. The necessary data including residence place (urban or rural) of bitten persons, age and job of people were collected during a 10-year period from 21 March 1994 to 21 March 2003 from all regional cities including the urban and rural areas of the province. Data were analysed by chi-square, Fisher's exact test, Pearson correlation coefficient, Student's t-test and Kolmogrov Smironov test using SPSS (v. 11.5). The results of the present study showed that the fatal cases of human rabies in the province of Kerman from 1994 to 2003 were 10 persons (8 males and 2 females), half of whom had been bitten by dogs and the others by foxes. No human rabies reported in 1994 in Kerman province. 47% of animal bitten persons had been injured through feet; 41% hands; 7% trunks; 3% faces and 2% through head and neck. From all (21,546 people) who had been bitten by animals during the studied period, 55.57% were living in rural and 44.43% in urban areas; 79.36% of them were treated by non-completed rabies prophylaxis regimens and 20.64% received completed rabies prophylaxis-treatment regimens. The most common affected age group was 10–19-year-old persons; the least was children aged under 4 years. Males were more frequently (73.48%) affected than females (26.52%) ($P<0.01$). We found that there was a significant inverse correlation between the amount of annual raining and the incidence of animal bites ($r = 0.5$, $P = 0.01$); the incidence of animal bites was increased during the drought years. The increasing number of stray dogs and cats should not be ignored by public health authorities as well as Veterinary Public Health Organizations related to strategic programs of rabies control in the southeast of Iran.

Key words: Retrospective study, Animal bites, Rabies, Kerman, Iran

Introduction

Rabies is an acute fatal viral encephalitis that usually transmitted from animals to man followed by domestic and wild animal bites (Rad *et al*., 1999; Rad, 2004). Rabies disease is one of the most important public health problems in some countries of the world such as those in the Eastern Mediterranean region (WHO annual reports, 2000). According to the world health organization (WHO) reports, more than 10 million people who are bitten by animals are annually treated by prophylactic treatment regimen of rabies in the world. About 50,000 human deaths are annually reported due to rabies (Frederick *et al*., 1999; WHO, 2000). In Asia, most of the mortality cases of human

rabies were reported from the underdeveloped countries such as India, Pakistan and Bangladesh which have high populations and have no specific strategies for controlling rabies. The real numbers of human deaths due to rabies in these countries are more than these numbers, because there is no advanced surveillance system of disease control to find out the real numbers of infected and fatal human cases (WHO, 2001). Kerman province, as the largest province of Iran, is geographically located in the southeast of Iran (Astani *et al*., 1984). Considering the ecological diversity of 10 regional cities of this province and previous reported cases of rabies in human and animals, especially the prevalence of rabies in southern parts, the present study was undertaken to evaluate the prevalence and other informations about rabies as well as the variables related to the bitten persons during 1994 to 2003 in Kerman province, Iran. This project proposed to design a strategic protocol for prevention of rabies in human and animal populations of this province for the future prospective aspects. The recorded documented data such as numbers of persons who were bitten by animals and other important variables related to them such as habitants, genders, age groups, jobs and applied treatment (complete or non-complete) of referral human injured patients due to animal bites were also analysed (Rashidi, 2005).

Materials and Methods

In this descriptive analytical survey, data related to mortality of human rabies and all of recorded information related to persons who were bitten by animals from March 1994 to March 2003 were collected from documents of health centers of all cities and rural areas as well as Kerman and Rafsanjan Universities of Medical Science. Data related to laboratory diagnosis of the disease, concerning the confirmation of rabies of animal samples sent by Veterinary Organization of Kerman to Pasteur Institute of Iran, were obtained from the Institute as one of WHO collaborative reference centers in Tehran. These data were categorized and analysed according to the aims of this project. Data related to population of Kerman province were obtained from annual statistical bulletin of Kerman Province Planning Organization and the climato-logically data concerning the level of annually raining in different regions of Kerman province was obtained from Midriology Organization of Kerman province. All of the collected data were finally analysed by chi-square, Fisher exact test, Pearson correlation coefficient, Student's t-test and Kolmogrov Smironov (KS) test using SPSS (v. 11.5).

Results

During the studied period, 10 human cases of rabies were diagnosed through typical clinical symptoms. Based on these results, 80% of these persons were male and 20% were female. In the recorded clinical histories of these cases, 50% were bitten by foxes and 50% by dogs (Table 1). Forty percent of all mentioned victims were bitten by animals through hands (case Nos. 2, 5, 6 and 7 in Table 1), 40% through heads, faces, leg and nose (case Nos. 10, 9, 3 and 4 in Table 1) and 20% through other parts such as neck, trunk and shoulder (case Nos. 1 and 8 in Table 1). The highest human rabies cases fatality was reported from Kahnooj (n = 4) and Rafsanjan (n = 3); the least case fatalities were from Sirjan, Baaft and Bardsir cities (one case from each city). Nine out of 10 human patients were Iranian and one was Afghan. None of 10 patients, who were bitten by animals and died of rabies, had received the prophylactic treatment regimen or vaccination before passing away. Sixty percent of infected persons were farmers and workers; the remaining victims (40%) had different jobs such as housewives and students. The mean age of persons who died of rabies was 39.2 (range: 5–63) years (Table 1). The mean ± SD incubation period of rabies (from time of animal bite up to the time of clinical presentation) in those who were bitten through head and neck was 33 ± 12.2 days. However, the mean ± SD time of incubation period of rabies in persons who were bitten through hands and feet was 77 ± 45.8 days. The mean ± SD age of persons who were bitten by foxes and dogs were 57.25 ± 5.1 and 24.8 ± 14.6 years (P =

Table 1: Summarized data of ten human rabies patients who were bitten by animals and died in hospitals of different cities of Kerman province during 1994 to 2003

Case No.	Year	Cities	Gender	Nationality	Age (years)	Job	Site of bite	Prophylaxis-treatment	Incubation period (days)	Attacker animal
-----	1994	-----	-----	-----	-----	-----	-----	-----	-----	-----
1	1995	Rafsanjan	Male	Iranian	26	Worker	Neck	None	20	Fox
2	1996	Bardsir	Female	Iranian	52	Housewife	Hand	None	150	Fox
3	1998	Rafsanjan	Male	Iranian	54	Farmer	Face	None	42	Fox
4	2000	Baaft	Male	Iranian	63	Farmer	Nose	None	43	Fox
5	2001	Sirjan	Male	Iranian	41	Worker	Hand	None	90	Stray dog
6	2002	Kahnooj	Male	Iranian	60	Farmer	Hand	None	60	Fox
7	2002	Kahnooj	Male	Iranian	16	Student	Hand (finger)	None	53	Stray dog
8	2003	Kahnooj	Male	Iranian	5	Child	Trunk and shoulder	None	32	Shepherd dog
9	2003	Kahnooj	Female	Iranian	36	Housewife	Face and leg	None	30	Shepherd dog
10	2003	Rafsanjan	Male	Afghan	26	worker	Head	None	17	Shepherd dog

able 2: Number of persons who were bitten annually by animals from 1994 to 2003 in different cities of Kerman province, Iran

Years	Cities										Total cases per year
	Baaft	Bardsir	Bam	Jiroft	Rafsanjan	Zarand	Sirjan	Shahr-e-Baabak	Kerman and Ravar	Kahnooj	
1994	111	25	175	241	109	66	65	24	241	105	1162
1995	117	48	171	253	250	88	58	21	351	108	1465
1996	209	44	180	259	224	70	161	39	339	87	1612
1997	359	55	170	334	557	88	123	58	340	95	2179
1998	222	79	190	304	273	101	104	45	374	110	1801
1999	237	82	192	232	293	95	85	50	419	114	1799
2000	239	128	221	276	258	77	354	60	423	112	2148
2001	215	148	220	336	323	90	410	66	355	109	2272
2002	322	203	285	436	391	94	521	66	553	229	3100
2003	326	236	395	537	496	140	535	91	659	493	3908
Total	2357	1048	2199	3208	3173	909	2416	520	4154	1562	21546

0.004), respectively (Table 1).

The numbers of persons who were bitten by animals during the studied period in different regional cities of Kerman province are indicated in Table 2. The mean numbers of overall incidences of animal bites per year in 100,000 human populations of each counties of Kerman province during the studied period are shown in Table 3. The distribution of the studied variables such as people's habitant, gender, age group, job and the treatment received (complete or non-complete) are shown in Table 4. The increasing trend of animal bites is shown in Fig. 1, which is mostly prominent from 2001 to 2003. The statistical evaluations were performed by KS test with even distribution (P = 0.03). Concerning the injured limbs of all animal bitten persons in Kerman province (21546 individuals), 47% of them were injured through feet; 41% hands; 7% trunks; 3% faces and 2% of them through heads and necks (Fig. 2). Among all persons who were bitten by animals during 1994–2003, 55.57% were living in rural and 44.43% in urban areas. Concerning the gender of animal bitten persons, the frequency rate of males (73.48%) was more than females (26.52%) (P<0.01). The highest incidence rate of injured people by animals belonged in the age group of 10–19-years. The least rate belonged to age group of under 4-years.The age distribution of bitten persons is presented in Fig. 3. Among those who were bitten by animals, 79.36% (n = 17099) were treated by non-completed rabies prophylaxis treatment regimens and only 20.64% (n = 4447) were treated by the completed prophylaxis regimens (Table 4). Overall, we found that the trend of human animal bites was increasing over the studied period. The results of this study also showed that there is a significant inverse correlation between the annual rain fall and the incidence of animal bites (r = 0.5, P = 0.01); the incidence was increased during the drought years of 2000–2003. This finding was observed mainly in Kahnooj and Rafsanjan where the most human rabies cases were reported (Table 1).

Discussion

Data based on human animal bites showed compatibility with other researches in other parts of the country. These observations showed that the number of persons who were bitten by animals was correlated to various factors including geographical areas, jobs, gender and life

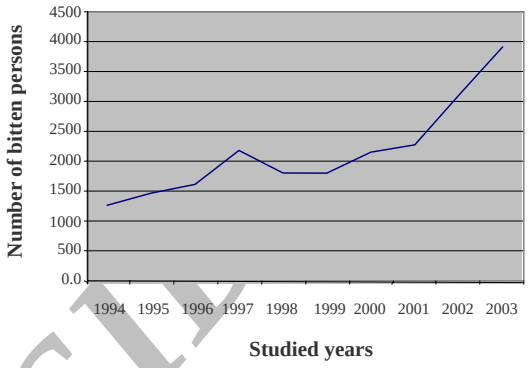

Fig. 1: Trend of animal bite frequency between 1994 and 2003 in Kerman province, Iran

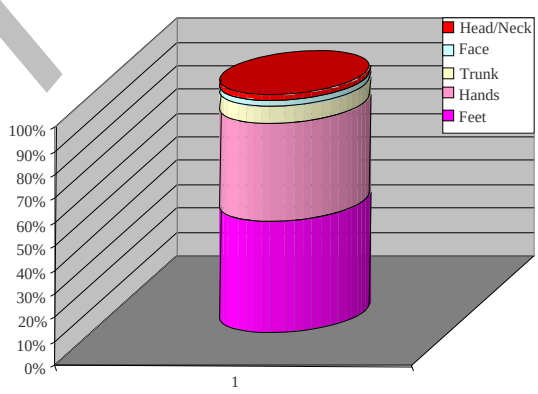

Fig. 2: Site of bites in persons who were bitten by animals during 1994-2003 in Kerman province, Iran

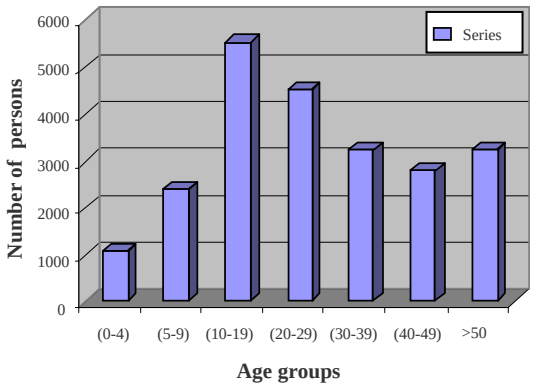

Fig 3: Age distribution of persons who were bitten by animals during 1994–2003 in Kerman province, Iran

Table 3: Overall incidence of animal bites per 100,000 human populations annually in different counties of Kerman province during 1994–2003

Counties	Annual average per 100,000 population	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Total numbers in one decade
Baaft	166	111	117	209	359	222	237	239	215	322	326	2357
Jiroft	143	341	253	259	334	304	232	276	336	436	537	3208
Bardsir	138	25	48	44	55	79	82	128	148	203	236	1048
Rafsanjan	115	109	250	224	557	273	293	258	323	391	496	3173
Bam	103	175	171	180	170	190	192	221	220	285	395	2199
Sirjan	101	65	58	161	123	104	85	354	410	521	535	2416
Shahr-e-Baabak	75	24	21	39	58	45	50	60	66	66	91	520
Kerman and Ravar	65	241	351	339	340	374	419	423	355	553	659	4154
Kahnooj	64.5	105	108	87	95	110	114	112	109	229	493	1562
Zarand	63	66	88	70	88	101	95	77	90	94	140	909
Total in province	1033.5	1262	1465	1612	2179	1801	1799	2148	2272	3100	3908	21546

style. According to results of this study, 73.48% of those who were bitten by animals were male (15832 out of 21546) and 26.52% (5714 out of 21546) were female (Table 4). Based on a research performed between 1994 and 1998 in Isfahan province, 88% of animal bitten persons were males (Manshuri, 2000). It seems that the higher incidence of disease and bites in males is due to their presence in open areas and their dare to fighting animals that is more common than females. There is also compatibility between the incidence of animal bitten persons in age group of 10–19-years in this study and other research (Nowrouzian *et al*., 1988; Manshuri, 2000). According to this study, the prominent age group was teenagers, which comprised 25.76% of all age groups (5550 persons out of 21546), and the least numbers belonged to the age group of less than 4-years (4.25%) with 917 persons (Table 4 and Fig. 3).

Table 4: Distribution of studied variables in persons who were bitten by animals during 1994-2003 in Kerman province, Iran

Variables	Scales	No. of persons	Variable percentage	P-value
Habitant	Urban	9573	44.43	0.01
	Rural	11973	55.57	
Gender	Male	15832	73.48	0.01
	Female	5714	26.52	
Age group (years)	0-4	917	4.25	0.02
	5-9	2267	10.52	
	10-19	5550	25.76	
	20-29	4260	19.77	
	30-39	3057	14.19	
	40-49	2639	12.25	
	>50	2856	13.26	
Jobs	Farmer	1163	5.40	<0.05
	Agriculturist	2902	13.47	
	Clerk	1719	7.98	
	Private jobs	3874	17.98	
	Worker	2144	9.95	
	Housewives	3079	14.29	
	Students	4744	22.02	
	Other jobs	1921	8.91	
Applied treatment	Complete	4447	20.64	0.001
	Non-complete	17099	79.36	

Feet (47%) and hands (41%) were the most affected regions that usually happen during the body defence against animal invasion (Fig. 2). Based on a research in Iran in Caspian Sea and Persian Gulf coastal regions during 1981–85 the reported injuries in persons bitten by animals were 49.20% in feet and 33.36% in hands that is almost similar to the results of the present survey. The overall incidence of animal bites in the coastal regions of Caspian Sea and Persian Gulf areas was 428.5 and 186 per 100,000 of human population per year, respectively (Nowrouzian *et al*., 1988). This incidence was 1033.5 people per 100,000 of human population per year in Kerman province (Table 3) which seems about 2.5-fold of what was reported from the coastal region of Caspian Sea (413 persons) and 5.5 folds of coastal region of Persian Gulf (187 persons) areas (Nowrouzian *et al*., 1988).

Number of human deaths caused by rabies was 10% of the whole annual death in country (Simani, 2003). The most human rabies cases reported during 1995–99 in Iran were from Fars and Chahar-Mahal provinces

(Simani, 2002). The number of human deaths due to rabies in Kerman province was increased to two and three persons in each of the years of 2002 and 2003, respectively (Table 1). These numbers were proportionate to the increase in rabies in the province due to animal bites. On the other hand, the more animal bites in each year, the more human deaths due to rabies in Kerman province. This situation is probably correlated to the unpleasant effects of sequential droughts in Kerman province that caused an increase in incidence of animal bites during the drought years such as 1997 (2179 cases), 2002 (3100 persons) and 2003 (3908 people). These data are shown in Table 2 in detail and are also presented schematically in Fig. 1.

The considerable point about the incidence of human rabies in Kerman province is the role of foxes in transmission of rabies to domestic animals as well as human, because 50% of attacker animals to the ten human cases in this survey were foxes (Table 1). This percentage in Iran was reported to be 25%; the most cases of human rabies caused by foxes bites belonged to Kerman and Bushehr provinces (Simani, 2002). The results of this study also emphasized the important role of wildlife in disseminating of human rabies in Kerman province which is almost similar to the findings of other investigators (Frederick *et al*., 1999; Rad, 2004; Simani, 2004). Therefore, conducting a research project on the prevalence of wildlife rabies in Kerman seems necessary to evaluate the presence of rabies strain virus in the wild animals such as foxes and mongooses which sometimes attack domestic animals or even people in the rural areas of Jiroft and Kahnooj regions in southern part of the Kerman province.

In this study, one interesting point was that the mean incubation period in rabies patients was 54 (range: 17–150) days and it varied depending on the site of bite. The incubation period in people whose head, neck and face were bitten was shorter than those whose hand and foot were bitten (Table 1). This finding is completely compatible with the classical forms of rabies in human medicine. Based on a study performed in Pasteur Institute of Iran on 44 cases, the mean incubation period was 71.35 days (except for one which was 344 days) (Simani, 2002). The difference in the mean incubation period could be related to the viral strain in wildlife or domestic animal resources (Simani, 2002; Rashidi, 2005). Investigations on rabies victims in Kerman province shows that unfortunately none of the injured people referred to neither a clinic nor a health center immediately to be lead to a branch of the Pasteur Institute of Iran for treatment. Consequently, they had not received any rabies vaccines for prophylaxis and antirabies serum for treatment. In most cases, after presentation of clinical symptoms, prophylactic-treatment regimen for rabies has been started based on WHO guidelines. To prevent infection of rabies virus penetration, antirabies serum was injected both systemically and locally; however, unfortunately because of virus settlement in the central nervous system (CNS) and appearance of clinical symptoms, the treatment-prophylaxis regimen was not effective. Hesitate in referring to physician and not paying attention to prevention procedures among animal bitten persons and their family who might be exposed to animal bites was correlated to their ignorance about the consequences. Sometimes, because of indulgent reactions of animal bitten persons or lack of sufficient information about rabies disease among staff in clinics, the disease may occur sporadically. Therefore, public announces and giving information to people by mass media in order to teach them how to face with this problem and how to impliment prevention processes is very important. According to previous investigations, high mortality in persons who were bitten by dogs in comparison with individuals who were bitten by foxes could be related to the sensitivity of human cases to strain of virus originated from dogs or foxes (Rad *et al*., 1999; Simani, 2004). It seems that the role of dogs in transmission of rabies is better appreciated than the role of foxes by most people in rural and urban areas of Kerman province. This survey implies that public health education and daily-announcing programs, which are broadcasted by mass media are highly important. It should be mentioned that the recorded number of animal bitten persons in Kerman province Health Centers was totally 1162 people in

1994, while this number was 3908 people in 2003 (Table 2). This means that the risk of animal bite in human populations of Kerman province was increased three times during the decade studied. The overall incidence of animal bites per year per 100,000 human population in Kerman province during 1994–2003 was 1033.5 (Table 3). The recorded mean number of animal bitten people in Kerman Health Centers (rural and urban areas) was 167 persons per 100,000 people per year in the whole province in 2003; this figure in comparison to 10 years before (1994) was 70.5 (Rashidi, 2005). Being bitten by wild and domestic animals, people could be at risk of exposure to rabies which is dangerous for public health, because the above-mentioned figure was doubled during 1994–2003. Based on findings in this study, the numbers of human cases bitten by animals (healthy, suspected or infected to rabies), recorded in Kerman province from 1994 to 2003, indicated an increasing trend (Fig. 1). Accordingly, the annual human mortality from rabies was also increased based on a research performed by Pasteur Institute of Iran. The number of persons who referred for prophylaxis treatment regimen in Iran against rabies in 1990 was 29860 persons, which increased to 93216 cases in 2003 (Simani, 2003). Based on another report, the number of persons treated for rabies in 1996 in Iran was 57070 persons, which increased in 1998 to 65632 (Simani, 2004). Over the studied period, we observed an increase in the incidence of animal bites in Iran. The increase might be in part due to improved surveillance system of health centers as well as the advancement of public health awareness and progress of the monitoring and reporting systems in Iran. Besides, the increased number of stray dogs and approaching of wild animals to cities, due to ecological changes, are among reasons of increasing animal bites in Iran. This could be specifically attributed to the increasing trend of human mortality due to increased rabies among animals in Kerman province. The evaluation of results showed that the number of persons who were bitten by animals was increased in those years when the annual rain fall was decreased (i.e., 1997, 2000, 2001 and 2002) (Rashidi, 2005). This phenomenon could be due to the invasion of some wild animals such as foxes and mongooses to the habitant areas of domestic animals and possibly human populations in Kerman province during the drought years. This hypothesis should be postulated by another research project to clarify the significance of role of wildlife in the epidemiology of rabies in southeast of Iran. The positive cases of wild animals which were confirmed by Pasteur Institute of Iran for rabies infection from 1993 to 2003 included three jackals, one wolf, one fox and one mongoose (Rashidi, 2005). The brain samples of these animals were sent to the Pasteur Institute of Iran for the diagnosis of rabies during the mentioned period by Kerman Veterinary Organization.

Ten cases of human rabies death were reported during 1994–2003 in Kerman province; 50% of these victims were bitten by foxes and 50% by dogs. No human rabies cases was reported in 1994 in Kerman province. There are reports on the role of foxes and other wild animals in epidemiology of rabies from different countries following ecological changes (Hanlon *et al*., 2001). Based on research by Tehran University and Pasteur Institute of Iran, in Jiroft and Kahnooj, Kerman province, fox may have a role in transmission of rabies from wildlife to the villages (Astani *et al*., 1984). The present study confirmed the epidemiologic role of infected foxes from wildlife to the domestic animals of Jiroft, southern part of Kerman province. The prevalence of rabies in winter and autumn was more than other seasons. Other investigators (Apple, 1987) also discussed the probable role of wildlife in the epidemiology of rabies in other countries.

In spite of recent mass vaccination against rabies in dogs scattered in Kerman province, the prevalence of rabies in animal bitten persons has not been decreased. This might be due to the role of wildlife in transmission of rabies from infected foxes, jackals, wolves and mongooses to human population. The other reason for this problem could be attributed to the insufficiency and non-continuous mass vaccination programs against rabies in southeastern provinces of Iran. According to other investigations, mass vaccination

programs against rabies would only be effective in controlling rabies, if at least 80% of animal populations in the region were vaccinated against this disease (WHO, 2001; Simani, 2004).

Acknowledgements

The authors would like to express their appreciations to the Research Council of University of Tehran, the Medical University of Kerman, the Medical University of Rafsanjan, Veterinary Organization of Kerman, Rafsanjan Vali-e-Asr University (RVU) and Pasteur Institute of Iran for their help in data collect. We would also like to extend our appreciation to the Veterinary Group of Academy of Sciences of the Islamic Republic of Iran for their partial financial supports.

References

Apple, MJ (1987). *Virus infection of carnivores*. 1st. Edn., Elsevier Science Publishers. B. V. PP: 163-179.

Astani, M; Etminani, AA; Nadalian, MG; Zakkarian, B; Rad, MA; Simani, S and Ossouli, M (1984). Epidemiologic study of rabies disease in the region of Jiroft (south of Kerman province). J. Fac. of Vet. Med., University of Tehran, Iran. 40: 1-15.

Frederick, A; Morph, E; Gibbs, E and Paul, J (1999). *Veterinary virology*. 3rd. Edn., Academic Press. PP: 432-438.

Hanlon, CA (2001). Experimental utility of rabies virus-neutralizing Human mab (monoclonal antibody) in post exposure prophylaxis. Vaccine. 19: 3834-3842.

Manshuri, K (2000). Retrospective study of rabies in Isfehan during 4 years (1994-1997). DVM Thesis in Faculty of Veterinary Medicine, Kerman University of Bahonar, Kerman, Iran. PP: 20-45.

Nowrouzian, I; Fayaz, A; Simani, S and Ossouli, M (1988). Animal bites: a statistical analysis of cases in Persian Gulf and Caspian Sea areas, Iran. J. Fac. of Vet. Med., University of Tehran, Iran. 43: 115-148.

Rad, MA (2004). *Zoonoses*. 3rd. Edn., compiled in Persian language, published by Tehran University Press. PP: 46-50.

Rad, MA; Firoozbakhsh, F and Hemmat, K (1999). *Zoonoses updates*. 1st. Edn., (compiled in Persian language from AVMA articles edited by William Clark), Published by University Press Center of Iran, Tehran, Iran. PP: 224-231.

Rashidi, H (2005). Epidemiologic survey of rabies during 1993-2003 in the province of Kerman, Iran. MPVM Thesis, Faculty of Veterinary Medicine, University of Tehran, Iran. PP: 83-100.

Simani, S (2002). Epidemiologic survey of human rabies in Iran from 1995 to 2000. J. Infect. Dis. Trop. Regions. 16 : 42-48.

Simani, S (2003). Epidemiological status of rabies disease in Iran. J. Fac. of Vet. Med., University of Tehran, Iran. 58 : 175-178.

Simani, S (2004). *Rabies disease book*. 1st. Edn., compiled in Persian language, Published by Pasteur Institute of Iran. PP: 24, 150-151.

WHO, Strategies for the control and elimination of rabies in Asia (17-21 July 2001). Report of a WHO interregional consultation Geneva, Switzerland. PP: 1-19.

WHO in the Eastern Mediterranean Region (2000). Annual reports of regional director (1950-2000), Alexandria World Health Organization (WHO), Regional Office for Eastern Mediterranean Region. PP: 2-3.