A retrospective study of dog bite occurrence and anti-rabies vaccination of dogs in a State Veterinary Hospital in Ogoja, Cross River State, Nigeria

Thomas I. Isek[1], Jarlath U. Umoh[2*] and Asabe A. Dzikwi[2]

[1]*Department of Veterinary Services, Ogoja Cross River State-Nigeria.*
[2]*Department of Veterinary Public Health & Preventive Medicine, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria-Nigeria.*

[*]*Corresponding author at: Department of Veterinary Services, Ogoja Cross River State-Nigeria. Tel.: +234 08182987757, +234 08037866550, e-mail: juumoh@yahoo.com.*

Veterinaria Italiana 2019, **55** (2), 163-168. doi: 10.12834/VetIt.150.431.5
Accepted: 05.10.2014 | Available on line: 30.06.2019

Keywords
Rabies,
Dog bite,
Dog vaccination,
Ogoja,
Nigeria,
Victims.

Summary
Rabies is one of the world's major zoonoses. Controlling rabies continues to pose a major public health challenge. The issues surrounding dog bites and the vaccination of dogs against rabies are important to consider in implementing programmes to control the spread of rabies. This is particularly true in Ogoja, Nigeria, where accessibility to adequate health care and veterinary medical services, and the management of canine populations are challenging. This retrospective study analyses factors associated with dog bites to humans and anti-rabies vaccination in dogs that were reported to a State Veterinary Hospital in Ogoja. Factors such as the age and sex of the dog bite victim, and season and site of bite, as well as the age, sex, breed, and vaccination history of the biting dogs were obtained for a period of 11 years (2001-2011). Out of 183 dog bite cases, 79 (43.2%) were to persons > 20 years of age. Anatomically, the majority of bite wounds – 20 (64.5%) – occurred on the lower extremities of the body. The seasonal distribution of bites indicates a higher frequency in the months of October and March (dry season). A total of 687 (43.9%) dogs were vaccinated out of 1,562 cases presented within the period of study. The highest vaccination rate was within the ages of 3-12 months (464 dogs, or 67.5%). In this study, dog bites were a common occurrence among male children > 20 years old, and the frequency of bites was high during the dry season. Proper sensitisation around how to manage dog bites and increase anti-rabies vaccination of dogs as a means of controlling the disease are recommended.

Studio retrospettivo sui morsi e sulla vaccinazione antirabbica nei cani nell'ospedale veterinario di Stato a Ogoja, Cross River, Nigeria

Parole chiave
Morso di cane,
Nigeria,
Ogoja,
Rabbia,
Vaccinazione per cani,
Vittime.

Riassunto
La rabbia è una tra le maggiori zoonosi mondiali e il suo controllo continua ad essere una sfida importante per la sanità pubblica. La vaccinazione dei cani e l'analisi delle morsicature sono fattori importanti da considerare quando si attuano programmi per controllarne la diffusione, soprattutto a Ogoja, in Nigeria, dove l'accesso a servizi sanitari e veterinari adeguati e la gestione delle popolazioni canine sono difficili. Questo studio retrospettivo ha analizzato alcuni fattori associati alle morsicature – l'età e il sesso della vittima del morso di cane, la stagione e il sito del morso, l'età, il sesso, la razza e la storia di vaccinazione dei cani – segnalate dal 2001 al 2011 ad un ospedale veterinario di stato a Ogoja. Di 183 morsi, 79 (43,2%) hanno interessato persone di età > 20 anni; la maggior parte delle ferite da morso – 20 (64,5%) – ha colpito le estremità inferiori del corpo. La distribuzione stagionale dei morsi ha evidenziato una maggiore frequenza nei mesi di ottobre e marzo (stagione secca). Dei 1.562 cani presi in considerazione nel periodo di studio, 687 (43,9%) erano stati vaccinati; il più alto tasso di vaccinazione ha riguardato la fascia di età tra 3 e 12 mesi (464 cani, 67,5%). Per un miglior controllo della malattia gli autori pertanto raccomandano un aumento delle vaccinazioni e un'adeguata sensibilizzazione sulla gestione dei morsi di cane.

Introduction

Rabies is caused by the rabies virus (RABV), a bullet-shaped, enveloped RNA virus belonging to the family *Rhabdoviridae* and genus *Lyssavirus type 1* (Takayama 2008). The disease infects domestic and wild animals, and is spread to people via infected saliva through bites, licking, or scratches (Idachaba *et al.* 2009). Once symptoms develop, rabies is nearly always fatal (WHO 2010). Rabies occurs in more than 100 countries and territories. Worldwide, more than 55,000 people die of rabies every year. A total of 40% of people who are bitten by a suspected rabid animals are children under 15 years of age. Dogs are the source of 98% of human rabies deaths (WHO 2010). The occurrence of rabies in humans and domestic animals is well known, but the role that wild animals play in its spread has not been determined (Umoh and Belino 1979). The virus is usually transmitted through the bite of an infected animal; corneal transplantation from an infected donor and viral inhalation may however also result in infection (Dzikwi *et al.* 2010, Takayama 2005). Rabies remains a serious public health hazard in many developing countries where dog bites continue to be the main mode of transmission to humans (Widdowson *et al.* 2002). Vaccination against rabies virus is a highly effective method of preventing rabies in humans and animals (Jakel *et al.* 2008). The control of dog rabies relies principally on the mass vaccination of dogs in order to achieve herd immunity levels sufficient to inhibit rabies transmission (Perry and Wandeler 1993). This also provides the most cost-effective and efficient strategy for controlling canine rabies (Clifton 2007). Free roaming or stray dogs and unvaccinated dog populations may increase the spread of the rabies virus. Developing countries including Nigeria are considered risk areas for rabies exposure. In Nigeria, the vaccination status of the rabies suspected dog should not be the only determinant for the initiation of post-exposure prophylaxis in humans (WHO 2010) as deaths have resulted from the bites of dogs which have allegedly been adequately immunised against rabies. Cases of rabies have been confirmed and reported in Calabar Cross River State, Nigeria (Owai 2009). In a rural community (Okoyong) in Cross River State, dog bites are reportedly prevalent (Asuquo *et al.* 2005). The situation may apply to other rural communities in the area considered in this study, as there has been an increase in dog bite cases reported to the veterinary clinic in Ogoja. There is dearth of information on the epidemiology and public health significance of canine rabies in Ogoja. Observations in the State Veterinary Hospital, Ogoja, indicate that dog bite cases are a frequent occurrence, hence the need to evaluate dog bite cases and their associated public health implications for the area. In this study, the objectives were first to analyse the distribution of dog bites according to the following criteria: age and sex of dog bite victim, site of the bite, season of occurrence, and second to evaluate the vaccination profile of dogs in order to assess the effectiveness of rabies control programmes that rely on immunisation.

Materials and methods

We reviewed dog bite records reported to the Veterinary Clinic, Ogoja, between January 2001-December 2011. Only reported and recorded cases of dog bites within the period under review were considered. Information relating to the age and sex of dog bite victims, the anatomic site of bite, and the date of dog bite were considered. Anti-rabies vaccination records noting the age, sex, and breed of dogs were also assessed. The ages of dog bite victims were grouped into < 10 years, 10-20 years, and > 20 years. The ages of vaccinated dogs were grouped into 3-12 months, > 12-36 months and > 36 months. The breed of vaccinated dogs were classified into 'local', 'exotic', and 'others'. Dogs less than 3 month old were not included in the study because this category did not appear in the records under scrutiny at the time of this study.

Seasonal variation of dog bites was determined by time series decomposition using ratio to moving average method. This was done by calculating the average of 12 months for each year, then centring the moving average (CMA) by taking the average of each two adjacent months and dividing the observed number of cases (y) by CMA to obtain seasonal variation (S). The average seasonal index (S) was plotted for each calendar month. Chi square or t-test statistical analysis was used where applicable, and values of $p < 0.05$ were considered significant.

Results

Our results showed that of 183 reported cases of dog bites from 2001-2011, 79 (43.2%) occurred in victims above 20 years, 68 (37.1%) victims were between 10-20 years, and 36 (19.7%) occurred in persons under the age of 10. Males had a higher frequency of bites (95, 51.9%) than females (88, 48.1%) (Table I). Bite wounds were more frequent on the legs (65%) than on the hand (29%), head, and back (6%) (Figure 1). None of the dog bite victims presented more than one anatomical location of wound.

Our findings show that the seasonal distribution of dog bites was most dense in October and March, peaking in October with 22 (12.0%) followed by January and March with 19 (10.4%), and December with 18 (9.8%). The fewest number of dog bite cases occurred in June, with only 9 (4.9%) reported cases. Time series decomposition using ratio to moving

Table I. *Distribution of dog bites in humans in Ogoja, Cross River State (Nigeria) according to age and sex (2001-2011).*

Year	Age (yrs)			Sex	
	< 10	10-20	> 20	M	F
2001	1 (2.8)	7 (10.2)	3 (3.7)	6 (6.3)	5 (5.6)
2002	4 (11.1)	10 (14.7)	15 (18.9)	20 (21.0)	9 (10.2)
2003	5 (13.9)	7 (10.2)	13 (16.4)	13 (13.6)	12 (13.6)
2004	5 (13.9)	11 (16.1)	13 (16.4)	13 (13.6)	16 (18.1)
2005	1 (2.8)	1 (1.4)	2 (2.5)	4 (4.2)	0 (1.1)
2006	3 (8.3)	8 (11.7)	4 (5.0)	8 (8.4)	7 (7.9)
2007	8 (22.2)	4 (5.8)	8 (10.0)	11 (11.5)	9 (10.2)
2008	0 (2.8)	3 (4.4)	4 (5.0)	2 (2.1)	5 (5.6)
2009	5 (13.9)	3 (4.4)	4 (5.0)	5 (5.2)	7 (7.9)
2010	3 (8.3)	5 (7.3)	6 (7.5)	6 (6.3)	8 (9.0)
2011	1 (2.8)	9 (13.2)	7 (8.8)	7 (7.3)	10 (11.3)
Total	**36**	**68**	**79**	**95**	**88**
%	**19.7**	**37.1**	**43.2**	**51.9**	**48.1**

Percentages are indicated in parentheses.

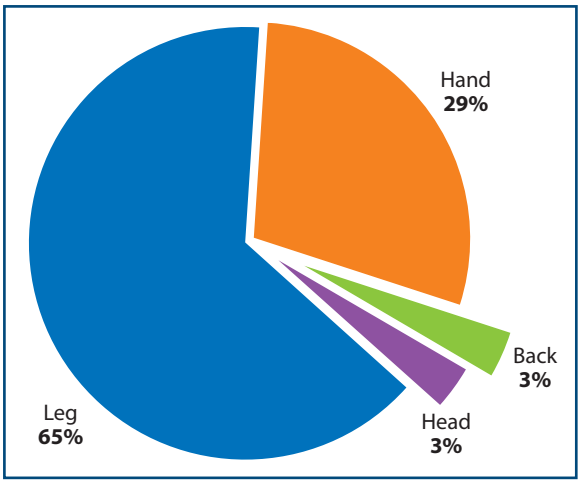

Figure 1. *Distribution of dog bites by anatomical location in Ogoja, Cross River State (Nigeria) from 2001-2011.*

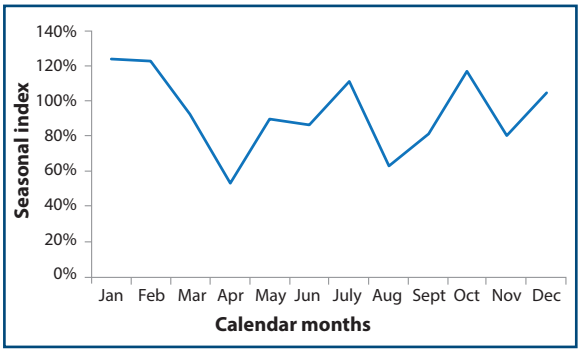

Figure 2. *Seasonal index of monthly dog bite cases in humans reported to the Veterinary Hospital, Ogoja, Cross River State (Nigeria) from 2001-2011.*

average method revealed seasonal fluctuations. Seasonal changes expressed as seasonal index showed the greatest values during the months of October and March. The lowest indices were observed in April and June, and the rest of the months were close to the average annual value (Figure 2).

Results of our analyses of annual rabies vaccination of dogs showed that out of 1,562 dog consultations presented to the clinic during the period of review, only 687 (43.9%) dogs received anti-rabies vaccinations (ARV). This is despite the fact that vaccination is one of the most reliable ways to prevent rabies in dogs. The highest rate of anti-rabies vaccinations (67.1%) was administered in 2008, with a slight reduction in number (103, 58.2%) in 2009. These frequencies are represented in Table II and Figure 3. Vaccination of dogs against rabies is a government policy and an effective way to prevent and control rabies. People get their dogs vaccinated through mass vaccination programmes or by presenting their dogs to the veterinary clinic.

Findings showed that Nigerian local dogs had the highest vaccination rate (94%). Exotic and other dog breeds received only 24 (3%) and 19 (2.8%) doses of ARV, respectively (Figure 4).

The annual distribution of vaccinated dogs by age and sex was carried out to determine the age category and sex of dogs that were frequently presented for rabies vaccination during the period. Each dog receives one dose of rabies vaccine annually. Available records indicate that out of 687 vaccinated dogs, 396 (57.6%) were males and 291 (42.4%) were female dogs. There were statistically significant differences in the mean frequency of dog vaccination between male and female dogs ($P < 0.05$) (Table III). Most of the dogs vaccinated (464, 67.5%) were within

Table II. *Annual distribution of vaccinated dogs among cases presented to the Veterinary Hospital, Ogoja, Cross River State (Nigeria) (2001-2011).*

Year	No. of dog consultation	No. of anti-rabies vaccinations	%
2001	99	9	9.1
2002	150	45	30
2003	154	67	43.5
2004	145	42	29.0
2005	71	32	45.1
2006	118	51	43.2
2007	161	69	42.9
2008	170	114	67.1
2009	177	103	58.2
2010	144	63	43.8
2011	172	92	53.5
Total	**1,562**	**687**	**43.9**

the ages of 3-12 months, followed by 131 (19.1%) dogs in the ages of > 12-36 months and 92 (13.4%) dogs > 36 months (Table IV). However, there were no statistically significant differences among the ages of dogs vaccinated.

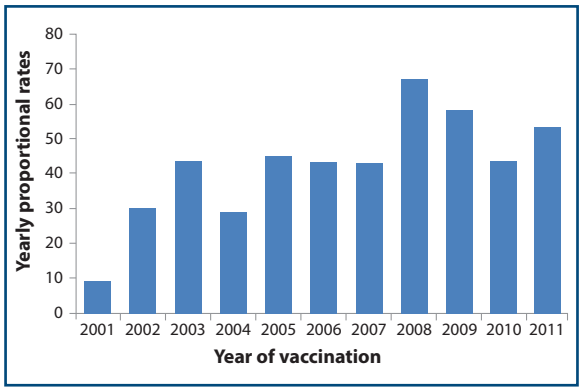

Figure 3. *Annual distribution of total number of dogs vaccinated against rabies in Ogoja, Cross River State (Nigeria) from 2001-2011.*

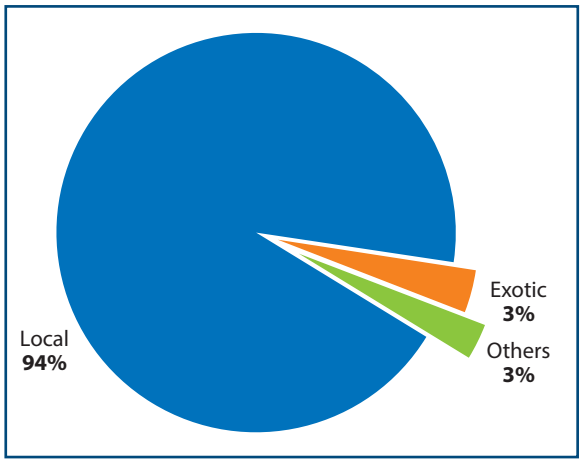

Figure 4. *Distribution of total number of anti-rabies vaccinated dogs according to breed in Ogoja, Cross River State (Nigeria) from 2001-2011.*

The Veterinary clinic, Ogoja, is a public (government-owned) clinic and is the only clinic in the urban town and its environs where veterinary services are provided. Its activity covers the urban and rural populace.

Discussion

Dog bites are of great concern to people. The high prevalence of dog bites among children (37.1%) between the ages of 10-20, and young adults > 20 years (43.2%) may be connected to the fact that this demographic tends to have more frequent contact with dogs, increasing their rate of exposure to bites. This finding is consistent with other reports (Lunney *et al.* 2011, Owai 2009, WHO 2010) of children in this age category as the major victims of, and more vulnerable to, dog bites. A similar study (Hambolu *et al.* 2013) conducted in Lagos, Nigeria, also demonstrated that the majority of dog bite victims were adults. Other authors (Abubakar and Bakari 2012, Ahmed *et al.* 2000, Hampson *et al.* 2008) have also reported higher bite frequencies among boys in other parts of the world. These studies confirm the fact that incidences of dog bites are increasing among boys.

Defensive aggression is likely a major contributing factor to dog bites. Bites to human legs and feet may be related to dogs protecting their territory. This study indicated a high frequency of dog bites to legs (64.5%) and the majority of the bite cases were associated with the local dog breeds that are predominantly found in the study area. The occurrence of dog bites to human legs may be due to the proximity of this part of the body to the animal. It is also likely that victims would have used legs to tease dogs, or attempt to separate fighting dogs, or defend themselves from a dog attack, which would result in more bites to the lower extremities. Local dogs are in most cases not confined, and so roam freely. All of these factors may increase the

Table III. *Distribution of anti-rabies vaccination according to sex of dog in Ogoja, Cross River State (Nigeria) from 2001-2011.*

Year	Sex		
	Male Frequency (%)	Female Frequency (%)	Total Frequency (%)
2001	3 (33.3)	6 (66.7)	9 (100)
2002	30 (66.7)	15 (33.3)	45 (100)
2003	43 (64.2)	24 (35.8)	67 (100)
2004	26 (61.9)	16 (38.1)	42 (100)
2005	20 (62.5)	12 (37.5)	32 (100)
2006	36 (70.6)	15 (29.4)	51 (100)
2007	44 (63.8)	25 (36.2)	69 (100)
2008	54 (47.4)	60 (52.6)	114 (100)
2009	53 (51.5)	50 (48.5)	103 (100)
2010	38 (60.3)	25 (39.7)	63 (100)
2011	49 (53.8)	42 (46.2)	91 (100)
Total	**396 (57.6)**	**291 (42.4)**	**687 (100)**

t = 3.6110; df = 10; p = 0.002.

Table IV. *Age-specific distribution of dogs vaccinated against rabies in Veterinary Hospital, Ogoja, Cross River State (Nigeria) from 2001-2011.*

Year	Age of vaccination in months (%)			Total
	3-12	> 12-36	> 36	
2001	8 (88.9)	0 (0)	1 (11.1)	9
2002	25 (55.6)	10 (22.2)	10 (22.2)	45
2003	45 (67.2)	16 (23.9)	6 (8.9)	67
2004	35 (83.3)	4 (9.5)	3 (7.1)	42
2005	23 (71.9)	5 (15.6)	4 (12.5)	32
2006	33 (64.7)	9 (17.6)	9 (17.6)	51
2007	44 (63.8)	21 (30.4)	4 (5.8)	69
2008	77 (67.5)	25 (21.9)	12 (10.5)	114
2009	81 (78.6)	10 (9.7)	12 (11.7)	103
2010	45 (71.4)	11 (17.5)	7 (11.1)	63
2011	48 (52.2)	20 (24.4)	24 (26.1)	92
Total	**464 (67.5)**	**131 (19.1)**	**92 (13.4)**	**687**

rate of interaction between dogs and humans, and therefore increase the risk of humans being bitten. The frequency of dog bites increased significantly during the dry season, from October to March. This could be attributed to dog owners going on hunting expeditions, which are common during this period and often involve local dogs. This would increase both the possibility of dogs breeding and humans being bitten. This finding was in line with the results of similar studies (Owai 2009, Tomori 1980, Umoh and Belino 1979) that noted that most outbreaks of rabies occur during the dry season, which coincides with the breeding season of dogs in most parts of Nigeria. The vaccination profile showed that local Nigerian dogs had a higher anti-rabies vaccination rate (93.7%) than other breeds considered in this study. This is because the population of local dogs is more predominant in the study area compared to exotic breeds that are more expensive to acquire and maintain. This observation, however, differs from the results of previous studies (Awoyomi *et al.* 2005) that found that local dog breeds were more likely to be unvaccinated compared to exotic breeds. Again, the high vaccination rate recorded in this study does not correlate with the results of other studies (Hambolu *et al.* 2014) that recorded dog vaccination coverage of 64.10% in the surveyed population. This could be explained through population dynamics and study area. Dogs within the 3-12 month age range had the highest vaccination rates. The high vaccination rate in these younger dogs may be related to advice to vaccinate dogs from 3 months old. These findings are not consistent with studies (Kaare *et al.* 2009) that found that pups less than 3 months were less likely to be vaccinated due to reasons such as lack of awareness about vaccinations. Theoretical and empirical studies have shown that the inclusion of puppies in rabies vaccination campaigns is likely to result in substantial epidemiological and economic benefits (Cleveland 1996, Coleman 1999). Dogs younger than 3 months play a significant role in transmitting rabies to humans (Mitmoonpitak *et al.* 1998). They are also more likely to be accessible for rabies vaccination than older dogs because they are closer to people and easier to restrain. The sex of dogs vaccinated in this study significantly affects the rate of rabies vaccination as more males (57.6%) were vaccinated than females (42.4%). The increased number of male dogs being vaccinated could be a result of male: female ratio dominance. Male dogs are more popular as a result of their increased aggression and thus effectiveness as security dogs and in hunting expeditions. The significant increase in the number of dogs vaccinated in 2008 was a result of an intensive mass campaign raising awareness about vaccinating dogs against rabies.

In conclusion, available veterinary records demonstrate that dog bites were a common occurrence among young adults (males) > 20 years old and that the frequency of bites was high during the dry season. Our analysis suggests that anti-rabies vaccinations were inadequate, especially in adult dogs, which constitute a higher risk of rabies transmission to humans. Moreover, poor veterinary record keeping could constitute a major challenge in the formulation of policies and prevention/control programmes for rabies in the area. Proper sensitisation around the management of dog bites and increased anti-rabies vaccination in dogs will help control the disease, but the success of this recommended course of action will require engaging communities through education and awareness programmes.

References

Abubakar S.A. & Bakari A.G. 2012. Incidence of dog bite injuries and clinical rabies in a tertiary health care institution: a 10-year retrospective study. *Ann Afr Med*, **11**, 108-111.

Ahmed H., Chafe U.M., Magaji A.A & Abdul-Qadir A. 2000. Rabies and dog bite in children: a decade of experience in Sokoto, Nigeria. *Sokoto J Vet Sci*, **1**, 2-10.

Asuquo M., Ndifon W., Ugare G. & Mwankon J. 2005. Prevalence of dog bites in a rural community: a 15 year review of cases in Okoyong, Cross River State, Nigeria. *Global Journal of Community Medicine*, **2** (1-2), 1597-9857.

Awoyomi O.J., Adeyemi I.G. & Awoyomi F.S.O. 2007. Socioeconomic factors associated with non-vaccination of dogs against rabies in Ibadan, Nigeria. *Nig Vet J*, **28** (3), 59-63.

Cleaveland S. 1996. The epidemiology of rabies and canine distemper in the Serengeti, Tanzania. PhD Thesis. University of London.

Clifton M. 2007. How to eradicate canine rabies in ten years or less. *Animal People Newspaper*. October 26.

Coleman P.G. 1999. The epidemiology and control of domestic dog rabies. PhD Thesis. University of London.

Dzikwi A.A., Umoh J.U., Kwaga J.K.P. & Ahmad A.A. 2010. Serological surveillance for non-rabies Lyssaviruses among apparently healthy dogs in Zaria, Nigeria. *Nig Vet Med J*, **31** (3), 214-218.

Hambolu S.E., Dzikwi A.A., Kwaga J.K., Kazeem H.M., Umoh J.U. & Hambolu D.A. 2013. Rabies and dog bites cases in Lagos State Nigeria: a prevalence and retrospective studies (2006-2011). *Glob J Health Sci*, **6** (1), 107-114.

Hambolu S.E., Dzikwi A.A., Kwaga J.K., Kazeem H.M., Umoh J.U. & Hambolu D.A. 2014. Dog ecology and population studies in Lagos State, Nigeria. *Glob J Health Sci*, **6** (2), 209-220.

Hampson K., Dobson A., Kaare M., Dushoff J., Magoto M. & Sindoya E. 2008. Rabies exposure, post-exposure prophylaxis and deaths in a region of endemic canine rabies. *PLOS Neglected Trop Dis*, **2**, 339.

Idachaba S.E., Olaleye S., Chuwukere S., Abechi A.S., Ehizibolo D.O., Fasina F.O., Bot C.J., Muhammad L.U., Nwosuh C.I., Okewole P.A. & Makinde A.A. 2009. Ten year (1998-2007) retrospective evaluation of the status of dog rabies in Plateau State, Nigeria. Proceedings 46th Annual Congr Nig Vet Med Ass, 73-78.

Jakel V., Konig M., Cussler K., Hanschmann K. & Thiel H.J. 2008. Factors inflencing the antibody response to vaccination against rabies. *Dev Biol (Basel)*, **131**, 431-437.

Kaare M., Lembo T., Hampson K., Ernest, E., Estes A., Mentel C. & Cleaveland S. 2009. Rabies control in rural Africa: evaluating strategies for effective domestic dog vaccination. *Vaccine*, **27**, 152-160.

Lunney M., Jones A., Stiles E. & Toews D.W. 2011. Assessing human-dog conflicts in Todos Santos, Guatamala: bite incidences and public perception. *Prev Vet Med*, **102**, 315-320.

Mitmoonpitak C., Tepsumethanon V. & Wilde H. 1998. Rabies in Thailand. *Epidemiol Infect*, **120** (2),165-169.

Owai P.U. 2009. A study of rabies in dogs in Calabar, Cross River State, Nigeria. *J Appl Sci*, **12** (3), 8648-8653.

Perry B.D & Wandeler A.I. 1993. The delivery of oral rabies vaccine to dogs: An African perspective. *Onderstepoort J Vet Res*, **60** (4), 451-457.

Takayama N. 2005. Clinical feature of human rabies. *Nippon Rinsho*, **63** (12), 2175-2179.

Takayama N. 2008. Rabies: a preventable but incurable disease. *J Infect Chem*, **14** (1), 8-14.

Tomori O. 1980. Wild life rabies in Nigeria: experimental infection and transmission studies with the shrew (*Crocidura* sp.). *Ann Trop Med Parasitol*, **74** (2),151-156.

Umoh J.U & Belino E.D. 1979. Rabies in Nigeria: a historical review. *Int J Zoonoses*, **6** (1), 41-48.

Widdowson M., Morales G.J., Chaves S. & McGrane J. 2002. Epidemiology of urban canine rabies, Santa Cruz, Boliva, 1972-1997. *Emerg Infect Dis*, **8** (5), 1-7.

World Health Organisation (WHO). 2010. Rabies Fact Sheet 99. http:www.who.intentity/mediacentre/factsheet/.