



Cairo University
International Journal of Veterinary Science and Medicine

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Full Length Article

Dog ecology, dog bites and rabies vaccination rates in Bauchi State, Nigeria



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Received 27 February 2014; revised 12 April 2014; accepted 12 April 2014
Available online 10 June 2014

KEYWORDS

Dog ecology;
Dog bites;
Rabies vaccination;
Bauchi State;
Nigeria

Abstract A study of dog ecology, dog bites and rabies vaccination rates was carried out in Bauchi the capital city of Bauchi State, Nigeria using direct street counts and questionnaire survey administered on 10% of the city streets selected by stratified random sampling. The questionnaire was designed to obtain data in order to determine the dog to human population ratio, dog management and care, cases of dog bites, consequences of the bites and frequencies of rabies outbreak. The estimated dog population of street counts and compound counts were 5310 and 7670, respectively. The overall human to dog ratio of 4.1:1 was established. The mean number of individuals per dog owning compound was 9.6 ± 0.498 (SEM) and the mean number of dogs owned per dog owning compound was 2.3 ± 0.108 (SEM). Majority of the dogs owned were local breeds (62.8%) aged between 1 and 5 years old and managed under partial or no confinement. The dogs were mostly used for security (69.5%) purposes. Dog owners reported low vaccination coverage (26.4%), level considered not sufficient to prevent rabies transmission. About 12.4% of dog bite victims died and majority of which (71.43%) manifested nervous signs before death. Domestic dogs have been shown to be tolerated and kept in Bauchi but poorly managed in terms of feeding, confinement and vaccination thereby constituting a continuous risk to domestic animals and humans.

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Peer review under responsibility of Faculty of Veterinary Medicine, Cairo University.



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1. Introduction

Rabies, a fatal nervous system disease of warm blooded animals including man is caused by a virus, belonging to the family *Rhabdoviridae*, of the genus, lyssavirus. It has been associated with animal bites for more than 3000 years and it is the oldest infectious disease known to medical science [1]. Human mortality due to rabies is estimated to be 60,000 deaths per year worldwide and millions of persons, primarily in the

developing countries of the tropical and sub-tropical regions undergo costly post exposure treatment [2].

In Nigeria, it is believed that rabies had been recognized quite early in time because of the various dialectic names by which it is called such as digbolugi, (Yoruba), ciwon kare, (Hausa), ginnaji, (Fulani), eboa idat (Efik) and arankita (Igbo) [3]. However, the first scientific report of rabies in man was in 1912, and in the dog, 1925 [4]. Since then rabies has been recognized as a major health problem and is known to be widespread in Nigeria [5].

Traditional rabies control measures in dogs have included mass vaccination, movement restriction and control of stray dogs. The measures have been effectively applied in most of the developed world since the 1940s, resulting in relatively effective control and in some cases elimination of dog and human rabies [6]. However, in Nigeria rabies control measures in dogs have not been effective and canine rabies is increasing and spreading.

Well-designed dog ecology and demographic studies are necessary [7]. Such studies have proved useful in planning rabies control in Asia, Latin America, and in the North, East, and Southern Africa [8,9]. Reports on studies relating to dog ecology in Nigeria are limited and currently information is only available for Kaduna [10], Lagos [11], Maiduguri [12] and Makurdi [13]. This present study is therefore aimed at studying dog population structure and cases of rabies among dog bite victims in Bauchi, the capital city of Bauchi State. The information obtained will be valuable for planning and developing sustainable dog rabies control programs and evaluate other public health risks associated with dogs (Table 1).

2. Materials and methods

2.1. Study area

Bauchi State is located between longitude 9° 15'E to 10° to 43'E and latitude 9° 55'N to 12° 45'N in the Northern Guinea/Sudan savannah zone of Nigeria. It covers a total land area of 66,514 square kilometers and has 20 LGAs. The State has an estimated population of about 5 million people based on 2006 census. Using a detailed map of the Bauchi Township obtained from Bauchi State Urban Development Board, the various socioeconomic and land use districts were plotted

and the Bauchi metropolis was stratified into five areas for the purpose of the study. These areas were (a) the Government Reservation Area (GRA) consisting of old and new GRA. (b) Bauchi township consisting of Wunti, Fadaman Mada, Igbo quarters, and Muda Lawal; (c) Bauchi native town consisting of Fada, Nasarawa, Jahun, and Bakaro; (d) Industrial zone consisting of Railway, Zango, Federal lowcost, and Gudum; (e) Yelwa consisting of Yelwan makaranta, Yelwan tudu, Gwallameji, Unguwan Ngas, and Kagadama areas.

2.2. Direct count estimation method

Ten percent (10%) of the streets in each area were randomly selected as described by [14]. A proforma form was designed for the study which consisted of street name, number of dogs seen, breed, sex and age of the dogs seen. The counting of dogs was carried out early in the morning between 6 a.m and 7.30 a.m. This time was selected because it corresponded with the period of maximum dog activity, less human activity and good visibility. Some youth from the stratified areas were selected and trained to carry out the counting of dogs. They surveyed the areas one at a time, walking up and down each of the selected streets and recorded number of dogs seen in each of the street, taking advantage of local areas that were best for observation such as specific market streets, rubbish dump sites, and known pathways. The number of counted dogs in the selected streets in each of the identified area was used to estimate the population of dogs in that area. An estimate of the entire dog population in the entire Bauchi metropolis was determined based on all the counts from the five areas.

2.3. Questionnaire and household survey estimation method

A structured questionnaire was designed for compound survey of dogs and in addition, information on zoographic and demographic aspects of dog ownership and attitudes of dog ownership was carried out. An adult member of every tenth compound on each side of the selected street was interviewed for about 10–20 min using the structured questionnaire which consisted of three parts: Part one covered information about household and dog population structure, part two dealt with the management of dogs and vaccination program while part three covered cases of dog bites, post exposure management,

Table 1 Street and compound dog counts in Bauchi metropolis.

Area (Stratum)	Street count		Compound count	
	+	++	*	**
Yelwa	160	1600	176	1760
GRA	105	1050	184	1840
Bauchi industrial zone	101	1010	137	1370
Bauchi city	109	1090	213	2130
Bauchi native town	56	560	57	570
Total	531	5310	767	7670

Key

+ Number of dogs in 10% street in the area (randomly sampled).

++ 100% estimate of street count.

* Number of dog in 10% compounds in the area (randomly sampled).

** 100% estimate compound count.

consequences, and possible frequency of rabies outbreaks. The data collected from the study were subjected to statistical analysis [15] and documented.

3. Results and discussion

The results obtained from the estimate of dog population in Bauchi metropolis showed that Nassarawa-Jahun area had fewer dogs by street and compound dog counts than Gudum area, GRA and Bauchi city. However, Yelwa (stratum 1) a community predominantly inhabited by students and staff from (Abubakar Tafawa Balewa University, Federal Polytechnic and College of Agriculture, Bauchi) with many people from different tribes whose cultures allow dog ownership has high population of dogs in both street and compound counts (Table 2).

The study showed that dog owning households had an average of 2.3 dogs per household, a finding which is in conformity with that from Kenya where an average estimate of 2.1 dogs per dog owning household was reported [6]. The mean dog to human ratio obtained in this study was 1:4.1. This concurs with reports from Zimbabwe with a ratio of 1:4.5 [16], Mexico with a ratio of 1:4.3 [17], Thailand with a ratio of 1:4.6 [18], and Madagascar with a ratio of 1:5 [19]. Similarly, it concurs with the findings from urban and rural areas of Borno State in Nigeria where a ratio of 1:4.1 and 1:3.2 respectively was reported [12] and a ratio of 1:4 reported in Markudi Benue State, Nigeria [13]. However, our finding is in variance with that from urban and rural Lagos Nigeria where a dog to human ratio of 1:21 and 1:45 respectively was reported [11]. These discrepancies in dog to human ratio in the different

study areas could be attributed to differences in socio-cultural, economic and religious status and beliefs of the inhabitants of the different study areas.

Dog owners in Bauchi keep dogs primarily for security purposes including safeguarding livestock from attacks by predators and also protecting their farm crops from destruction by wildlife. Despite this important service provided by the dogs, their care and management were mostly poor. Many were poorly fed and not confined and so forced to move around the neighborhood in search of something to eat from rubbish dumps. Such dogs are referred to as “neighborhood” or “community” dogs [20]. This type of management of the domestic dog has also been reported in Ecuador [21], Zambia [22], Zimbabwe [23], and Kenya [6]. In this study most of the dogs are recognizable and traceable to specific owners, but they enjoy free range. A dog from one household is permitted to wander the neighborhood and may be offered food in other households. This promotes straying, encourages the gathering of dogs in packs and facilitates easy contact between dogs and humans/domestic animals/wildlife and cycle of endemic canine rabies can be easily maintained. In addition, there are problems of environmental pollution, social nuisance of dog bites and increased human exposure risk to rabies (Table 3).

The relatively higher dog to human ratio per dog owning household obtained in this study could be attributed to the major reason why dogs were kept by the owners which is mainly for providing security for household, livestock and farm crops, reasons that are similar to reports from Zimbabwe [16], Zambia [17], Ecuador [21], Chad [24] and Madagascar [19]. Also, as observed during the study, some keep dogs for hunting purposes and most of these hunters keep three or more hunting dogs. The presence of Yankari and Lame-bura game reserves in Bauchi State have increased the level of dog ownership among the populace which are mostly used either for

Table 2 Dog population structure in Bauchi metropolis, Bauchi State Nigeria.

Parameters	Scores
Number of compounds interviewed	329
Total persons in all compounds	31,050
Total number of dogs in all compounds	7670
Mean number of dogs/dog owning household	2.3
Human:dog ratio	4.1:1
<i>Sex distribution</i>	
Male	53.46%
Female	46.54%
Male to female dog ratio	1.2:1
<i>Age distribution</i>	
< 1	33.68%
1–5	56.58%
> 5	9.64%
<i>Breed distribution</i>	
Indigenous breed	62.84%
Exotic breed	19.95%
Crossed breed	17.21%
<i>Function of dogs</i>	
Security	69.47%
Pet	14.42%
Hunting	8.41%
Breeding	7.21%
Herding	0.48%

Table 3 Management and care of dogs in Bauchi metropolis, Bauchi State, Nigeria.

Parameters	Scores (%)
<i>Confinement</i>	
Never	35.87
Partial	22.80
Always	26.74
Unknown	14.59
<i>Care providers</i>	
Father	9.73
Mother	13.03
Children	15.20
Everybody	62.00
<i>Feeding of dogs</i>	
Family left over	62.92
Cook special food	25.84
Buy commercial food	11.24
<i>Causes of dog depopulation</i>	
Giving away	49.24
Disappear	13.98
Intentionally killed	9.42
Automobile accident	9.12
Death due to diseases	18.24

hunting and or guarding of farm crops and livestock from attacks by predators.

The breed, age and sex distribution of dogs population obtained in this study showed that majority of the dogs kept by owners are the indigenous breed which are mostly cheap and easy to obtain and aged between 1 and 5 years. Other investigators have also identified this age range as most active in the lives of dogs [11,12]. Also, as observed during the study, most people keep more male dogs as compared to female dogs. This is consistent with other reports [21,16,19] and this preference appears to be due to the belief that male dogs make better guards and hunters and also female dogs attract a lot of male dogs to the house during their mating periods.

The study showed low vaccination coverage against rabies. This is insufficient to control the spread of rabies and also indicative of lack of awareness amongst the general public on the dangers of rabies posed by unvaccinated dogs in the study area. To have an effective control of rabies, vaccination coverage of 70–75% is considered necessary [20] (Table 4).

The opinion of respondents who had knowledge on cases of dog bites in the study area showed that dog bite cases do occur frequently among family members and the dog bite victims were mostly bitten by dog with owners (household dogs and neighbors dogs). Other investigators have reported similar findings [12,25]. This suggests that circumstances of dog bite or transmission of rabies is not always due to stray dogs but even the owned dogs may be involved in transmission of rabies (Table 5).

The study showed that 12.4% of dog bite victims died after manifesting some abnormal nervous signs and none of them received anti rabies post exposure prophylaxis following the bite. This is a possible reflection of lack of knowledge on the dangers of rabies among the public as only 35.40% of the respondents indicated that the dog bite victims received anti rabies post-exposure treatment whereas majority of other victims prefer non-specific management approaches like the traditional medication which involves roasting the liver and brain of the biting dog to be taken by the victim, the application of the offending dog's hair on the bite wounds and the use of herbs. These have failed in saving the lives of such victims. Also, cases of health care workers prescribing canine vaccine to human victims of dog bites as post exposure prophylaxis were observed during the study a serious concern on the lack

Table 4 Vaccination history of dogs in Bauchi metropolis.

Parameter	Scores (%)
<i>Vaccination of dogs against rabies</i>	
Vaccinated	63.83
Not vaccinated	26.45
Unknown	9.72
<i>Facility where vaccination was carried out</i>	
State Veterinary Clinic	25.87
NVRI Laboratory Bauchi	20.28
College of Agriculture Vet Clinic	4.20
At home	49.65
<i>Evidence for vaccination of the dog</i>	
Pet record book	34.97
Certificate of vaccination	25.87
Oral declaration	39.16

Table 5 Knowledge on cases of dog bites, management and consequences in Bauchi metropolis.

Parameter	Scores
<i>Family member bitten by a dog</i>	
Bitten	113 (34.35%)
Not bitten	216 (65.65%)
<i>Owner of offending dog</i>	
Household dog	34 (30.09%)
Neighbors' dog	52 (46.02%)
Stray dog	27 (23.89%)
<i>What happened to the dog?</i>	
Died	4 (3.54%)
Killed	25 (22.12%)
Healthy	50 (44.25%)
Unknown	34 (30.09%)
<i>Treatment given to victim</i>	
Anti rabies post exposure prophylaxis	40 (35.40%)
Local wound treatment using antibiotics	18 (15.93%)
Traditional (herbal) dog bite treatment	25 (22.12%)
No any specific treatment	30 (26.55%)
<i>What happened to the victim?</i>	
Healthy	85 (75.22%)
Died	14 (12.39%)
Unknown	14 (12.39%)
<i>If the victim had died, was any abnormal behavior seen?</i>	
Yes	10 (71.43%)
No	4 (28.57%)

of knowledge on rabies among some primary health care workers. Most people that died of rabies have either never been treated or have received some treatment, but not in accordance with the WHO protocol [26]. The holistic nature of traditional medication has prompted victims of dog bite to psychologically and culturally accept this mode of treatment and this is of serious public health concern.

4. Conclusion and recommendation

The study have shown that dogs are kept and tolerated in Bauchi, the capital city of Bauchi State, but poorly managed in terms of feeding confinement and vaccination with concomitant lack of knowledge on the dangers of rabies among the populace and death occurring among dog bite victims. It is therefore recommended that for effective control of the disease, Government at all levels should include free vaccination for dogs and proper post exposure management in its health policy, this should however be coupled with enlightenment campaigns to general public on responsible dog ownership, dangers of rabies and proper actions needed to be taken following dog bites.

Acknowledgements

The authors acknowledge the contributions of staff of the National Veterinary Research Institute Diagnostic Laboratory Bauchi for their support especially during the street and compound survey of dogs within Bauchi Metropolis.

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