Dog Ecology and Management in Niger State, Nigeria: A Basic Tool for Rabies Control

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Authors' contributions

This work was carried out in collaboration between all authors. Authors AG, AAD, HMK and JUU designed the study, performed the statistical analysis, wrote the protocol and the first draft of the manuscript. Authors AG, OAM, FOH, NOA and IPEC administered the questionnaires/data collection while authors AG, ABT and SEH performed the literature searches. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Aims: To examine the dog ecology and management as it relates to the control of rabies in Niger State, Nigeria.
Study Design: Questionnaire based survey.
Place and Duration of Study: Structured questionnaires on dog ecology and management were administered in Niger State of Nigeria between January and March 2012.

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Methodology: Structured questionnaires on dog ecology and management comprising of 4 sections, were administered to 300 adult participants between the ages of 18-70 years using systematic randomization; 237 questionnaires were returned. Descriptive statistics using the SAS statistical package were employed to analyze the data.

Results: Results indicated that there was a population ratio of 1:5.4 dogs to humans and 1:1.9 female to male dog ratio with an estimated 732,476 dog population in Niger State. Most of the dogs (58.6%) in the state were kept for security reasons and that majority of the dogs strayed at night (52.4%) and evenings (23.8%) into homes across the state. About 52% of dogs were not confined and responsibility for dogs in terms of welfare, mostly (61.5%) lied on everybody in the family and 61% of dogs were fed on family left overs. About 30.4% of dogs were never vaccinated and 31% of the respondents (or their family members) have been inflicted with a dog bite, but only 28.1% of cases received post-exposure prophylaxis (PEP). For those humans that were bitten, about 13.8% resulted in death.

Conclusion: Due to free roaming and irregular vaccination of dogs in the state; there is bound to be increased dog bite cases/rabies spread. This study concludes that dogs were not catered for as expected in the state and that employment of dog ecological studies before any rabies control programmes, will explore necessary data for planning the programme in Niger State of Nigeria. Improvement and employment of dog ecological studies across states for rabies control programmes in Nigeria and W/Africa is hereby recommended.

1. INTRODUCTION

Dog population dynamics have a major impact upon the effectiveness of rabies control strategies. For this reason, understanding domestic dog ecology especially in Nigeria where the dog is the principal reservoir host for rabies, has been recognized as central to the design of effective rabies control programmes. The population dynamics of dogs is an important factor in the epidemiology of endemic canine rabies. Lack of reliable estimates of dog populations hampers rabies control campaigns in developing countries, as cost benefit analysis of control strategies cannot be made accurately. The WHO "Guidelines for dog rabies control" has stressed the need for research on dog populations and ecology in urban and rural areas [1]. Determination of dog population density (dogs/km^2) from established indicators of dog abundance (dog to human ratio and dogs per household) is one recommended procedure [1,2].

Unlike livestock kept in herds on farms or housed in flocks, dogs are owned in small numbers in widely and randomly scattered households [2]. Until recently, there appears to be no standardized field technique available for general application in dog population studies. One parameter is an estimation of dog population density, calculated from the dog to man ratio or dog per household and expressed as dog per unit area [1]. Various workers have applied different techniques for estimating dog population densities. These techniques include total street-dog count [1], estimates from the rate of capture [3] and estimates from rate of re-capture of the same dog [4]. Most of these methods are adapted from techniques developed for estimating the density of wild animals in their natural habitat [1].

In Nigeria, the first report of human rabies was in 1912 and that of canine rabies was in 1925 [5] and a number of ecological studies have been conducted using questionnaires and street dog counts in order to estimate the dog population of some states. For instance, Okoh [6] reported a dog to human ratio of 1:4.2 in Jos. Dog to man ratios for urban and rural areas were 1:21 and 1:45 or 47 per 1,000 persons and 21.7 per 1,000 persons, respectively from Southeastern Nigeria [2]. A 1:4.10 and 1:3.20 ratios were reported from urban and rural areas of Borno State respectively [7]. More recently, a dog to human ratio of 1:4 was reported in residential areas of Makurdi, Benue State of Nigeria [8]; a dog: human ratio of 1:5.6 was reported from Lagos State [9]. Similarly, a dog to human ratio of 1: 7.8 was reported in Aba town of Abia State, Nigeria [10]. In this report, dog ecological study was used as a basic tool to generate data for rabies control in Niger State of Nigeria.

2. METHODOLOGY

Niger State which occupies about 9% of the total Nigeria land space was used to explore dog

ecology. A total of 300 structured questionnaires were distributed in the three senatorial districts of Niger State. The questionnaire comprises of 4 sections with a total of 40 questions. Section (a) was on demography of respondents, including age, location, household size etc, section (b) on dog population and structure, including keeping of dogs, number of dogs, sex, breed, age, purpose of keeping dogs, acquisition, depopulation, confinement, etc. Section (c) on dog feeding and health management, including responsibility to dogs, feeding of dogs, vaccination, health care offered etc and section (d) was on dog bite cases, management and sequela, including household member (s) ever been bitten by dog, fate of offending dog, fate of victim, who own the dog, health status of dogs, causative agent of rabies etc. Four major towns Bida, Kontagora, Suleja including the state capital Minna were conveniently selected. In every selected town, a major road that crosses the town was first identified and from one end towards the other, every third street radiating from the road were selected from the left and right hand sides of the road using systematic randomization method. In the same way every

third house/compound (on the left and right) in the selected streets were used to administer the questionnaires to the most senior and enlightened member of the family in the households. Most senior and enlighten member of the family was known by asking question from amongst the household. Only about 20% respondents accepted and filled/completed the questionnaires instantly and returned. Majority of the respondents were given 3 to 4 days to complete and return the completed questionnaire to us on our 2nd or 3rd visit or took them to designated Veterinary Clinics in the study area. Of the 300 questionnaires distributed only 237 were completed and returned. Of the 237 returned, 30 were discarded due to lack of merit (majority and relevant questions in such questionnaires were not answered), 207 were actually used. Data were entered into Microsoft excel 2010 spread sheet, cleaned and coded then Imported into SAS statistical program version 9.3 to generate the frequencies of variables. Information generated was summarized into tables and charts using Microsoft office tools.
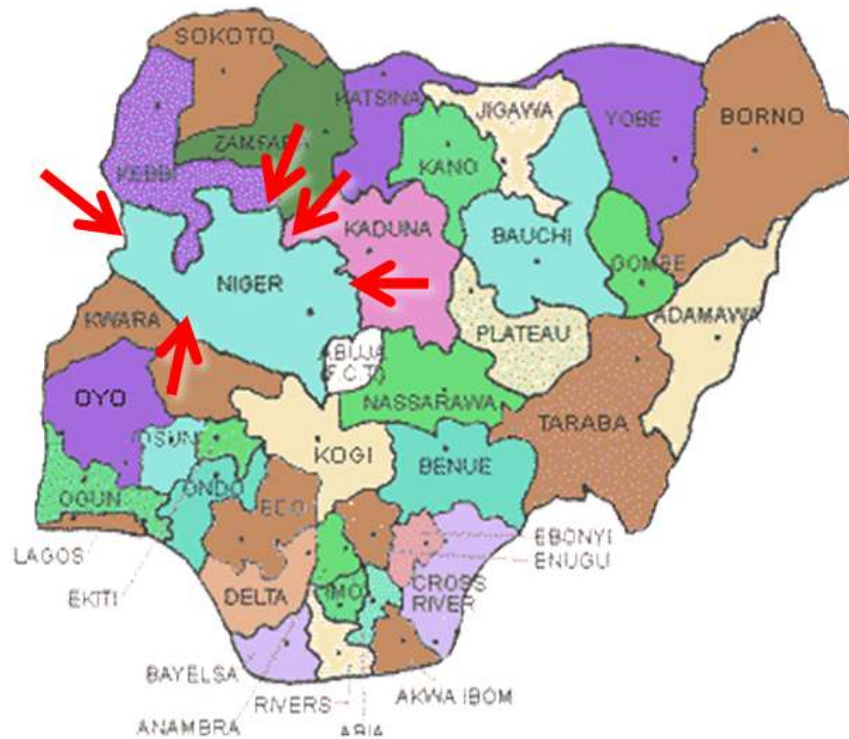

Fig. 1. Administrative map of Nigeria showing 36 states and Abuja (Niger state bounded with arrows) [11]

3. RESULTS AND DISCUSSION

There appears to be an increased in dog population with close proximity of dogs to humans in the recent years in Niger State as compared with two decades ago. In 1991 the human population in Niger State of Nigeria was 2.42 million [12] and a dog population of 199,812 (with 98.5% in the villages and 1.5% in the township) of the state [13]. This gives a dog to human ratio of 1:12.1 as at 1991. Unlike now which showed that there is a ratio of 1:5.4 dogs to human ratio in Niger State (Table 1). This brought the current estimate of the dog population to 732,476 (1 part of current 5.4 part human population) which is a ratio compared with the actual human population of 3,955,372 in Niger State as at 2006 population census (Table 1) [14]. This result also indicated a dog to human population dynamics, either there is actual increase of dogs due to increase human population activities or due to increased insecurity in the country that demands keeping of more dogs. What it suggests is that a closer tight/interaction of dogs to human exist now which could pose a greater public health risk if some dogs became rabid and have close interaction/ access to humans as compared with the dog to human ratio of 1:12.1 in 1991. Furthermore, for every two male dogs there is one female dog and over 75% of dogs were below the age of 5 years (Table 1). This may suggest that higher rate of dog bite in the state

could be seen especially that male dogs are associated with greater risk to bite than female dogs [15]. Similarly, over 60% of dogs in Niger State are native breed with about 25% being exotic breeds (Table 1). It putrayed the keeping of dogs for security reason especially due to reasonable percentage of the exotics dogs kept that have more security prudence.

The majority (58.6%) of the dogs in the study area were kept for security reasons with a lower proportion (8.6%) kept as pets (Fig. 2). This may infer that due to insecurity in the state of recent times that made individuals keep dogs for security. Most of the populace (66.7%) in Niger State like keeping dogs and mostly acquire dogs through purchase (60.4%) or given by their friends or relatives (29.6%) and only a few (3.1%) acquired dogs when they strayed into their houses (Table 2). This suggests that although most dogs stray in to homes majority, though free roaming, are owned dogs, only a few stray and never come back home in the state. Furthermore, only 5.8% (of puppies) and 1.5% (of adult dogs) disappeared or strayed away and over 66.2% of the respondents do not allow dogs stray into their compounds (Table 2).

Good proportion (55.1%) of the free moving (both owned and un-owned) dogs strayed into homes at night with the least proportion (8.2%) that strayed in the afternoons (Fig. 3). It implies that straying of dogs into houses is a

Table 1. Dog population and structure in Niger State, Nigeria

	Variables	Frequency	
		No.	%
a.	**No. of compounds visited**	207	
	No. of persons	1965	
	No. of dogs	366	
	Man to Dog ratio	5.4 : 1	
	Estimated Human*: Dog population	3,955,372* :732,476	
b.	**Sex distribution of dogs**		
	Male	238	65
	Female	128	35
	Male to Female ratio	1.9 : 1	
c.	**Age distribution of dogs**		
	< 1 year old	120	32.8
	1 – 5 year old	155	42.3
	> 5 year old	91	24.9
d.	**Breed of dog**		
	Native	220	60.1
	Exotic	93	25.4
	Mixed	53	14.5

Key: No. = Number, % = Percentage,
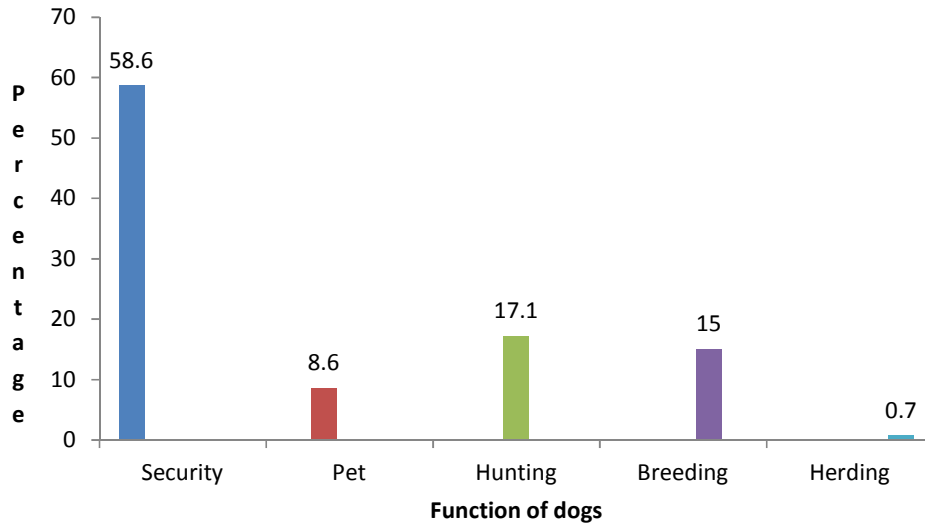** = Estimate based on NPC census, 2006*

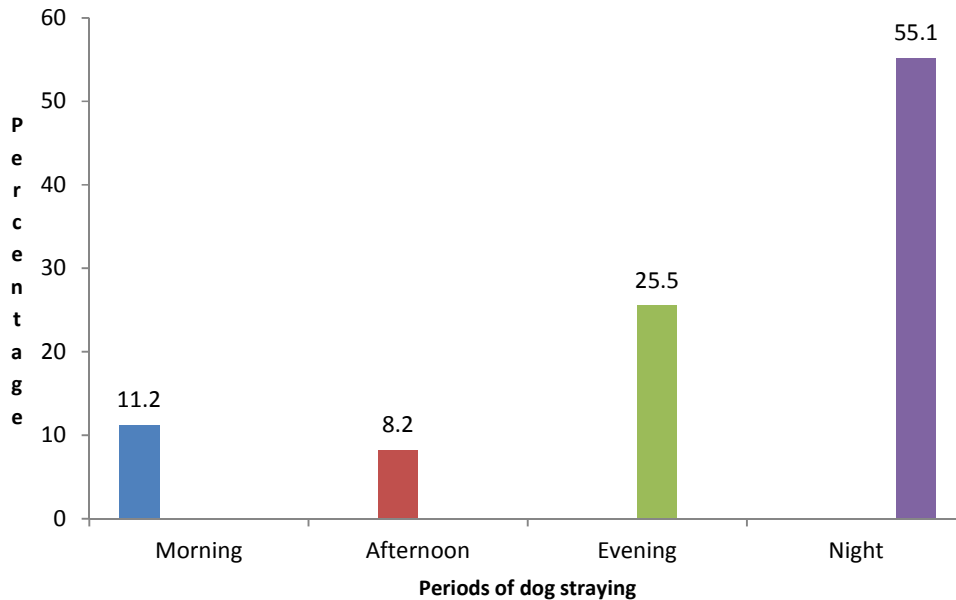**Fig. 2. Purpose of keeping dogs in Niger State, Nigeria**

**Fig. 3. Prevalent periods in which dogs strayed into houses in
Niger State, Nigeria**

usual occurrence especially at night, so catching for quarantine of unvaccinated/unlicensed dogs could better be done in the evenings and nights when they are abundantly seen. Similarly, a good proportion (79.7%) of dogs that strayed into homes while they do other things like eating of leftover food; they principally mate with other dogs in the houses if found and that only few proportion (2.9%) of the straying dogs played with children. This infers that most dogs mate at night due to assumed safety and which favoured their straying at night as well to seek/ eat leftover food and garbage. In this process if the straying dog is rabid; it could spread the disease amongst the populace and other dogs in the houses which is a serious public health risk.

It was equally observed that some of the dogs (26.9%) were confined or are partially (25%) confined (Table 3). It suggests that majority are free roaming dogs in the study area despite a good number of them being owned dogs. Furthermore, responsibility for dogs, mostly (61.5%) rely on everybody in the house / compound and 60.1% of the dog feed were from the family leftover (Table 3). This implies that responsibility for all is a responsibility for none, hence everyone assumes that the other will take care of the dog while it is not the case, thus, dogs live to their subsistence especially that they are mostly fed with family left over which appears to be absent nowadays

Table 2. Dog acquisition, depopulation and straying in Niger State, Nigeria

	Parameters	Frequency %	
a.	**Do you like keeping dogs?**		
	No	33.3	
	Yes	66.7	
b.	**How do you acquire dog?**		
	Friends and relatives	29.4	
	Neighbours	6.9	
	Purchase	60.6	
	Roam into my house	3.1	
c.	**How do you depopulate your dogs?**	**Puppies**	**Adult**
	Give out	51.5	46.7
	Sale	42.6	30.6
	Disappear/stray away	5.9	1.5
	Die	0	20.4
	Automobile accident	0	0.7
d.	**Do you allow dogs stray into your compound?**		
	No	66.2	
	Yes	33.8	

Key: % = Percentage

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

	Parameters	Frequency %
a.	**Confinement of dogs**	
	Never	26.9
	Partial	25
	Always	48.1
b.	**Who takes care of dog?**	
	Father	18.6
	Mother	6.4
	Children	13.5
	Everybody	61.5
c.	**How are dogs fed?**	
	Family left over	60.1
	Cook special pot	38.5
	Allow to scavenge	1.4
d.	**Do you vaccinate dogs?**	
	No	30.4
	Yes	69.6
e.	**How often do you vaccinate?**	
	Once in life time	42.9
	Twice in life time	8
	Regular annually	49.1

due to financial recession. Although about 50% of the dogs received anti-rabies vaccine regularly; yet over 42% of the dogs received vaccines only once in their life time (Table 3). This indicates that a good number of free roaming dogs are not vaccinated/revaccinated against rabies, which is a public health risk for dissemination of rabies virus. Similarly, the preferred vaccine/regimen by respondents is injectable vaccine (69.7%) than the oral (30.3%) even if available. It also suggests that for future anti-rabies vaccination campaigns in Nigeria, the vaccine of preference is the injectable. For those that do not vaccinate their dogs against rabies, majority (38.9%) claimed the vaccine was expensive, yet over 34% have no idea that anti-rabies vaccine was available or existed. This result suggests that rabies awareness campaign is key to any successful anti-rabies vaccination campaign in Nigeria.

It was observed from this study that 31% of respondents or their family members have been inflicted with dog bite and that the majority (42%) of the dogs that bite are owned by households (Table 4). This suggests that dog bite is an occurring phenomenon in the state and since most of the offending dogs are owned by the households (a characteristic of a rabid dog not recognisjng and even biting owners of the dog). The bites (31%) may be due to undiagnosed rabid dogs, particularly, that 24.2% of those dogs that inflicted bites were sick or mad as at the time of the bite and 13.8% of the bite victims died aftermath (Table 4). It further portrays the risk inherent to such bites and possible dissemination of rabies virus. It was sad to note that only 28.1% of dog bite victims went for post exposure prophylaxis and that over 70% relied on wound dressing and traditional methods (Table 4). This is not healthy for the populace of Niger State and Nigeria at large, it further suggest the relevance of awareness creation at all levels.

About 61% of biting dogs remained healthy, but 33.7% of the offending dogs got killed instantly following the bite. Traditional methods such as cooking and feeding the victim with cooked part (viscera or flesh) of the dog (in 50% of the cases) and to some extent concoctions or incantations were commonly used in treating dog bites.

Furthermore, about 23.1% of respondents in the study area believed that rabies was caused by evil spirits. This suggests an urgent need for government to take deliberate steps in creating awareness about rabies and its effects in the study area.

Table 4. Dog bite cases, management and sequela, in Niger State, Nigeria

	Parameter	Frequency %
a.	**Has any family member been bitten by dog?**	
	No	69
	Yes	31
b.	**If yes, who own the dog?**	
	Households	42.3
	Neighbors	29.6
	Stray dog	28.1
c.	**Health status of the dog?**	
	Healthy	56.8
	Mad/sick	24.2
	Nursing bitch	19
d.	**Treatment to the victim**	
	Local wound dressing	39.3
	Post – exposure prophylaxis	28.1
	Traditional methods	32.6
e.	**What happens to the victim?**	
	Died later	13.8
	Remain healthy	78.8
	I do not know	7.4

Key: % = Percentage

4. CONCLUSION

Despite the lack of published reports on the presence of rabies in Niger state, it is evident from this study that serious indicators of rabies (dog bite and death of victims) is present in the study area. The pattern of dog ecology and management in Niger State is about the same as seen in other parts of Nigeria and much of African countries. Dog to human ratio was found to be 1:5.4 with an estimated 732,476 dog population in Niger State. The majority of dogs in Niger State though owned are allowed to see to their subsistence except for a few who are catered for. There were at least 31% victims of dog bite cases amongst the respondents or their relatives.

5. RECOMMENDATIONS

It is recommended that dog ecological studies be employed in all areas of Nigeria and West Africa before national or regional rabies vaccination campaign is organized. This will facilitate the WHO declaration to eliminate rabies by the year 2030.

CONSENT

Informed consent was sought from the participant before collection and filling/answering the questionnaires. Participants were allowed to decline filling any section of the questionnaire and could opt out of the study at any time.

ETHICAL APPROVAL

Ethical clearance and approval was obtained from Ahmadu Bello University Teaching Hospital Ethical committee's approval no. ABUTH/HREC/TRD/36.

DISCLAIMER

The title of this manuscript "Dog Ecology and Management in Niger State, Nigeria: A basic Tool for Rabies Control" was presented in the RIWA conference in Accra, Ghana in March 2016 as poster presentation.
Conference name: "3rd International Conference on Rabies in West Africa".
Conference link:
"http://ccpz.ui.edu.ng/sites/default/files/RIWA%20Ghana%20Conference%20Programme%20-%202016.pdf"

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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