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Original Article

Knowledge and Practices Regarding Rabies Prevention among Dog Owners in Sokoto, Nigeria

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Abstract

Introduction: Despite the fact that rabies elimination is feasible through vaccination of dogs and prevention of dog bites, it still causes tens of thousands of deaths every year, mainly in Asia and Africa. Rabies is endemic in Nigeria and is attributable to increasing human activities involving dogs, poor knowledge of the disease, and low level of vaccination of dogs.

Objectives: This study aimed to assess the knowledge and practices regarding rabies prevention among dog owners in Sokoto, Nigeria

Materials and Methods: A cross-sectional study was conducted among 190 dog owners selected by multistage sampling technique. Data were collected with a set of pretested interviewer-administered questionnaire; and analyzed using IBM SPSS version 20 software.

Results: The mean age of the respondents was 34.0 ± 9.9 years; majority of them were males (84.7%) and reside in urban areas (65.8%). Most of the respondents (86.8%) were aware of rabies with family/friend being the main source of information (82.4%). Less than half of respondents (43.7%) had good knowledge of cause and transmission of rabies, and only a few had good knowledge of its symptoms and signs (16.3%), and its prevention (21.1%). Majority of respondents (53.7%) allow their family members to play with dogs, <½ (48.4%) restrict dog movement, and only a few (16.3%) wear personal protective equipment while handling dogs. About a quarter of respondents (28.4%) had vaccinated their dogs in the past 12 months, and about a third (35.8%) reported rabid or suspect rabid dogs. Close to a quarter of respondents (23.7%) reported dog bites in their households, and most of the victims (77.1%) were bitten by their own dogs.

Conclusion: Government and other stakeholders should organize periodic awareness campaigns through the mass media to educate dog owners on rabies prevention, as well as annual free or subsidized mass dog vaccination campaigns.

Key words: Dog owners, Knowledge, Practices, Rabies prevention

INTRODUCTION

Despite the fact that rabies elimination is feasible through vaccination of dogs and prevention of dog bites, it remains widely distributed and constitutes a potential threat to about 3.3 billion people in more than 150 countries and territories.[1] Although the mortality from rabies is grossly underreported, it is believed to account for an estimated 55,000 deaths annually; and while the disease constitutes a huge economic burden estimated at USD 1 billion annually worldwide, the burden is disproportionately high in Africa and Asia, with an economic burden estimated at USD 583.5 million annually, and deaths due to human rabies in Africa and Asia amounting to 1.74 million disability-adjusted life years annually.[1-3]

A distinct feature of the transmission of rabies is the fact that in up to 99% of human cases, the rabies virus is transmitted by domestic dogs.[1] The virus is spread through infected saliva in bites, scratches and through licks from infected animals in open wounds or on mucosal membranes, or from infectious material such as brain tissue from a rabid animal.[1,4-6] This explains why even though all

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age groups are susceptible to the disease, it is more common in children <15 years. The World Health Organization (WHO) estimates that up to 40% of people who are bitten by suspect rabid animals are children under-15 years of age, and an estimated 40% of post-exposure prophylaxis worldwide is given to children 5–14 years of age.[1,7] Furthermore, at greater risk than the general population are certain occupational groups including veterinarians, dog handlers, hunters, field naturalists or journalists, and laboratory staffs working with rabies virus.[7]

Rabies is endemic in Nigeria; studies conducted across the country reported the presence of rabies viral antigen in the brains of about a third of apparently healthy dogs.[6,8,9] The high endemicity of rabies in Nigeria has been attributed to several factors including poor awareness of the disease, lack of knowledge and information about the disease, increasing human activities involving dogs (such as hunting and dog trading), increasing interactions between domestic and stray dogs, and low level (<50%) of anti-rabies vaccination coverage of dogs in the country.[2,6,10,11]

Poor knowledge of rabies transmission, clinical features and prevention are considered to be a major obstacle to its prevention. It is important for members of the public to have information on the clinical signs of a suspect rabid dog, rabies fatality, what to do in the event of a suspected dog bite, and preventive measures such as seeking post-exposure prophylaxis when a bite occurs and bringing their dogs to rabies vaccination campaigns.[5,12,13] Furthermore, in line with the health belief model which states that the perceived severity of a particular health problem influences adoption of health behaviors that prevent them from occurring or reduce their severity,[14] individuals are, therefore, more likely to observe the rabies prevention practices if they are aware of its high fatality.

Studies conducted in Nigeria and other places reported wide variations in the knowledge of rabies, and it was found to be associated with sociodemographic factors. In a study conducted among dog meat processors and consumers in Zaria and Kafanchan, Nigeria, whereas 68.8% of respondents knew sudden aggression by a previously friendly dog as a sign of rabies, majority of respondents (71.2%) were unaware of the fatal nature of the disease. Furthermore, the proportion of respondents with good knowledge of rabies increased from 25% among those with no formal education to 59% among those with tertiary education.[10] It is believed that educated persons have access to print and electronic media which give information on rabies and other diseases. Similarly, a study in Plateau State, Nigeria, reported that whereas majority of respondents knew the signs of rabies to include dog that bites without provocation (63%), friendly dog that suddenly becomes aggressive (63%), only 34.8% were aware of the fatal nature of rabies in humans.[15]

A study conducted among dog owners in Bahir Dar, Ethiopia, found that while majority of respondents had correct knowledge of the cause of rabies (60.1%), its clinical signs (76.8%), and the fatal nature of the disease (94.9%), and only very few (8%) had correct knowledge of its transmission.[16] Contrary to the poor knowledge of rabies transmission in the Ethiopian study, a community based survey in Tanzania, by Sambo *et al.*[13] reported that majority of respondents knew that rabies is transmitted through the bite of a rabid dog (81%) and that the disease is fatal (67%). Similarly, a study conducted in Namibia by Haimbodi *et al.*[17] reported that 90.6% of respondents identified dog bite as a primary means of transmission, 38% recognized convulsions and hydrophobia as symptoms of rabies, and 84.5% knew that vaccines exist to prevent the disease.

It is believed that elimination of rabies is feasible through compliance with rabies prevention practices such as responsible ownership and vaccination of dogs; while mortality from the disease is preventable through appropriate care of wounds (including washing with soap and water), and post-exposure prophylaxis. It is commonly perceived that many African communities are characterized by low levels of responsible dog ownership.[13] Responsible dog ownership is being promoted as the keystone of reducing the population of stray dogs and also of reducing the number of human cases of dog bites and transmission. Responsible dog ownership includes, for example, to take responsibility for the dog's welfare and health and to make sure it does not run around unsupervised and does not pose a risk to people.[5] To have a large population of stray dogs in a community is considered to be a risk for a zoonotic disease such as rabies[2,5] and likewise playing with strange/ownerless dogs.[12]

Mass dog vaccination is the most effective measure to control rabies and prevent human deaths.[13] The vast majority of human rabies deaths can be prevented through sustained dog vaccination programs. Annual anti-rabies vaccination and public enlightenment campaign aimed at achieving at least 70% vaccination coverage that is necessary for maintaining the required level of herd immunity in the vaccinated population irrespective of dog population turnover rates such as deaths, births, immigration, and emigration in the period between campaigns,[6] are crucial to the control of rabies and to eventually eliminate the disease among the dog population. While several countries endemic to rabies do not succeed in getting optimal vaccination coverage,[5] isolated studies conducted in Nigeria, including Zaria and Kafanchan,[10] Plateau State,[15] and Taraba

States,[18] reported high dog vaccination coverage rates of 96.6%, 97.8%, and 86%, respectively. Despite the high population of farmers and other occupational groups with high risk of exposure to rabies infection in Sokoto, Nigeria, little is known about the knowledge and practices regarding rabies prevention among the groups at risk. This study was conducted to assess the knowledge and practices regarding rabies prevention among dog owners in Sokoto, Nigeria. The findings from the study would be useful to policymakers, human resource managers, and other stakeholders in designing appropriate strategies and interventions for the elimination of rabies in the study area.

MATERIALS AND METHODS

Study Design, Population, and Area

This was a cross-sectional study among dog owners with established households and with dogs of vaccination age (6 months) in Sokoto metropolis, Nigeria, in April and June 2017. Five of the 23 Local Government Areas (LGAs) in Sokoto State are in Sokoto metropolis, with an estimated population of 1,232,197 projected for 2017 based on the 2006 census.[19]

Sample Size Estimation and Sampling Technique

The sample size was estimated at 199 using the statistical formula for calculating sample size for cross-sectional studies,[20] a 13.5% prevalence of dog vaccination from a previous study,[18] a precision level of 5% and an anticipated response rate of 90%.

The eligible participants were selected by a multistage sampling technique. At the first stage, two wards were selected in each of the 5 LGAs in Sokoto metropolis by simple random sampling using the ballot option. At the second stage, 10 areas/settlements were selected in each of the selected wards by simple random sampling using the ballot option. At the third stage, selection of participants was done in the selected areas/settlements by systematic sampling technique after doing a line listing of households that meet the inclusion criteria in the selected areas/settlements. Proportionate allocation of the study participants was done based on the projected population of the respective LGAs.

Data Collection and Analysis

A structured interviewer-administered questionnaire was used to obtain information on the study participants' sociodemographic profile, dog ownership and demography, knowledge of cause and transmission, symptoms and signs and prevention of rabies, as well as practices regarding rabies prevention. The questions were adapted from the questionnaires used in previous similar studies.[10,21,22] The questionnaire was pretested on 20 dog owners in Tambuwal LGA (situated outside Sokoto metropolis). The necessary modifications were made based on the observations made during the pretesting. Five Community Health Officers and Five Health Information Officers assisted in questionnaire administration after pre-training on conduct of survey research, the objectives of the study, selection of study participants and questionnaire administration.

Data were analyzed using IBM SPSS version 20 computer statistical software package. Respondents' knowledge of the cause and transmission of rabies was scored and graded on a 6-point scale. One point was awarded for a correct response, while a wrong response or I don't know response received no points. This gives a minimum score of "0" and a maximum score of "6" points. Those that scored ≥4 of 6 points were considered as having "good" knowledge, while those that scored <4 of 6 points were graded as having "poor" knowledge. Respondents' knowledge of the symptoms and signs of rabies was scored and graded on a 10-point scale. One point was awarded for a correct response, while a wrong response or I don't know response received no points. This gives a minimum score of "0" and a maximum score of "10" points. Those that scored ≥6 of 10 points were considered as having "good" knowledge, while those that scored <6 of 10 points were graded as having "poor" knowledge.

Respondents' knowledge of rabies prevention was scored and graded on a 12-point scale. One point was awarded for a correct response, while a wrong response or I don't know response received no points. This gives a minimum score of "0" and a maximum score of "12" points. Those that scored ≥8 of 12 points were considered as having "good" knowledge, while those that scored <8 of 12 points were graded as having "poor" knowledge. Respondents' practices regarding rabies prevention were scored and graded on a 6-point scale. One point was awarded for a practice that reduces exposure to rabies infection, while a practice that increases exposure to rabies infection received no points. This gives a minimum score of "0" and a maximum score of "6" points. Those that scored ≥ 4 of 6 points were considered as having "good" rabies prevention practices, while those that scored <4 of 6 points were graded as having "poor" rabies prevention practices. Frequency distribution tables were constructed; and cross-tabulations were done to examine the relationship between categorical variables. The Chi-square test was used for bivariate analysis involving categorical variables, while multivariate logistic regression analysis was used to determine the predictors of good practice of rabies prevention. All levels of significance were set at $P < 0.05$.

Ethical Consideration

Institutional Ethical Clearance was obtained from the Ethical Committee of Ministry of Health, Sokoto state, Nigeria. Permission to conduct the study was obtained from the administration of the respective LGAs and the traditional heads of the settlements where the study was conducted. Informed written consent was also obtained from the participants before data collection.

RESULTS

Sociodemographic Characteristics of Respondents

Of the 200 questionnaires administered, 190 were adequately completed and found suitable for analysis, giving a response rate of 95%. The mean age of the respondents was 34 ± 9.9 years, and most of them 146 (76.9%) were aged 20–39 years. Majority of respondents were males (84.7%), married (71.1%), Hausa/Fulani (74.7%), practiced Islam as religion (77.9%), and had at least secondary education (52.6%). A larger proportion of respondents (37.4%) were either into business or were artisans (37.4%), followed by farmers/hunters (33.2%); and majority of them (65.8%) reside in urban communities [Table 1].

Table 1: Sociodemographic characteristics of respondents

Variables	Frequency *n*=190 (%)
Age group (years)	
<20	4 (2.1)
20–29	67 (35.3)
30–39	79 (41.6)
40–49	22 (11.6)
≥50	18 (9.5)
Sex	
Male	161 (84.7)
Female	29 (15.3)
Marital status	
Single	49 (25.8)
Married	135 (71.1)
Separated	2 (1.1)
Widowed	4 (2.1)
Tribe	
Hausa	109 (56.3)
Fulani	35 (18.4)
Yoruba	18 (9.5)
Igbo	20 (10.5)
Others	10 (5.3)
Religion	
Islam	148 (77.9)
Christianity	42 (22.1)
Education	
Primary and below	90 (47.4)
Secondary and tertiary	100 (52.6)
Occupation	
Unemployed/Housewife	21 (11.0)
Farmer/hunter	63 (33.2)
Business/artisan	71 (37.4)
Civil servant	35 (18.4)
Residence	
Urban	125 (65.8)
Rural	65 (34.2)

Awareness of Rabies Among Respondents

Most, 165 (86.8%) of the 190 respondents had heard of rabies, and the most common sources of information were friends/neighbors (82.4%), and the mass media (13.3%). Only a few of them (6.8%) had attended any training on rabies [Table 2].

Table 2: Awareness of rabies among respondents

Variables	Frequency (%)
Ever heard of rabies(*n*=190)	
Yes	165 (86.8)
No	25 (13.2)
Source of information*(*n*=165)	
Friends and neighbors	136 (82.4)
Workplace	18 (10.9)
Mass media	22 (13.3)
Campaigns by NGOs	7 (4.2)
Previous training on rabies (*n*=190)	
Yes	13 (6.8)
No	177 (93.2)

*Multiple responses allowed. NGO: Non-governmental organizations

Respondents' Knowledge of Rabies

Less than half 83 (43.7%) of the 190 respondents had good knowledge of the cause and transmission of rabies. Only a few 20 (16.3%) had good knowledge of its symptoms and signs, and about a fifth 40 (21.1%) had good knowledge of its prevention [Figure 1].

Good knowledge of the cause and transmission of rabies was associated with the respondents' tribe, religion, and place of residence. The proportion of respondents with good knowledge of the cause and transmission of rabies was significantly ($P < 0.05$) higher among the other tribes (70.8%) as compared to Hausa/Fulani (34.5%), Christians (64.3%) as compared to Muslims (37.8%), and those who reside in urban communities (50.4%) as compared to those who reside in rural communities (30.8%) as shown in Table 3. Multivariate logistic regression analysis did not show any predictor of good knowledge of the cause and transmission of rabies.

Good knowledge of the symptoms and signs of rabies was associated with the respondents' tribe, occupation, and place of residence. The proportion of respondents with good knowledge of the symptoms and signs of rabies was significantly ($P < 0.05$) higher among the Hausa/Fulani (20.0%) as compared to the other tribes (3.6%), farmers/hunters (29.8%) as compared to those in other occupations (7.9%), and those who reside in rural communities (33.3%) as compared to those who reside in urban communities (2.9%) as shown in Table 3. Multivariate logistic regression analysis did not show any predictor of good knowledge of symptoms and signs of rabies.

Table 3: Distribution of respondents' knowledge of rabies by their sociodemographic characteristics

Sociodemographic variables	Knowledge of rabies					
	Knowledge of cause and transmission *n*=190		Knowledge of symptoms and signs *n*=190		Knowledge of prevention *n*=190	
	Good *n* (%)	Poor *n* (%)	Good *n* (%)	Poor *n* (%)	Good *n* (%)	Poor *n* (%)
Age (years)						
<40	62 (41.6)	87 (58.4)	16 (16.3)	82 (83.7)	27 (18.1)	122 (81.9)
40 and above	20 (50.0)	20 (50.0)	4 (16.7)	20 (83.3)	12 (30.0)	28 (70.0)
	χ^2=0.904, *P*=0.342		χ^2=0.002, *P*=0.968		χ^2=2.717, *P*=0.099	
Sex						
Male	67 (41.6)	94 (58.4)	20 (17.9)	92 (82.9)	32 (19.9)	129 (80.1)
Female	16 (55.2)	13 (44.8)	0 (0)	11 (100)	8 (27.6)	21 (72.4)
	χ^2=1.836, *P*=0.175		χ^2=2.346, *P*=0.126		χ^2=0.879, *P*=0.348	
Marital status						
Single, separated, widowed	24 (43.6)	31 (56.4)	2 (6.7)	28 (93.3)	11 (20.0)	44 (80.0)
Married	59 (43.7)	76 (56.3)	18 (19.4)	75 (80.6)	29 (21.5)	106 (78.5)
	χ^2=0.000, *P*=0.993		χ^2=2.682, *P*=0.101		χ^2=0.052, *P*=0.820	
Tribe						
Hausa/Fulani	49 (34.5)	93 (65.5)	19 (20.0)*	76 (80.0)	22 (15.5)	120 (84.5)
Others	34 (70.8)*	14 (29.2)	1 (3.6)	27 (96.4)	18 (37.5)*	30 (62.5)
	χ^2=19.423, *P*<0.001		χ^2=4.287, *P*=0.038		χ^2=10.453, *P*=0.001	
Religion						
Christianity	27 (64.3)*	15 (35.7)	1 (4.3)	22 (95.7)	18 (42.9)	24 (57.1)
Islam	56 (37.8)	92 (62.2)	19 (19.0)	81 (81.0)	22 (14.9)	126 (85.1)
	χ^2=9.302, *P*=0.002		χ^2=2.948, *P*=0.086		χ^2=15.424, *P*<0.001	
Education						
Primary and below	17 (28.3)	43 (71.7)	11 (24.4)	34 (75.6)	1 (1.7)	59 (98.3)
Secondary and tertiary	31 (40.8)	45 (59.2)	7 (13.5)	48 (86.5)	12 (15.8)*	64 (84.2)
	χ^2=2.278, *P*=0.131		χ^2=1.925, *P*=0.165		χ^2=7.736, *P*=0.005	
Occupation						
Farmer/hunter	23 (36.5)	40 (63.5)	14 (29.8)*	33 (70.2)	3 (4.8)	60 (95.2)
Others	60 (47.2)	67 (52.8)	6 (7.9)	70 (92.1)	37 (29.1)*	90 (70.9)
	χ^2=1.973, *P*=0.160		χ^2=10.222, *P*=0.001		χ^2=15.050, *P*<0.001	
Residence						
Rural	20 (30.8)	45 (69.2)	18 (33.3)*	36 (66.7)	2 (3.1)	63 (96.9)
Urban	63 (50.4)*	62 (49.6)	2 (2.9)	67 (97.1)	38 (30.4)*	87 (69.6)
	χ^2=6.699, *P*=0.010		χ^2=20.607, *P*<0.001		χ^2=19.208, *P*<0.001	

*Statistically significant

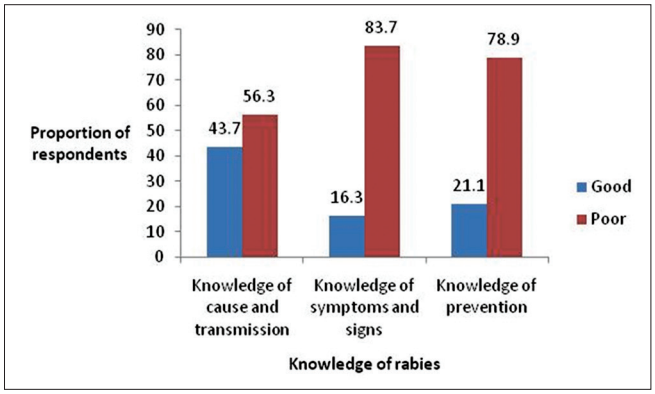

Figure 1: Respondents' knowledge of rabies

Good knowledge of rabies prevention was associated with the respondents' tribe, religion, education, occupation, and place of residence. The proportion of respondents with good knowledge of rabies prevention was significantly ($P < 0.05$) higher among the other tribes (37.5%) as compared to Hausa/Fulani (15.5%), Christians (42.9%) as compared to Muslims (14.9%), those with secondary or tertiary education (15.8%) as compared to those with primary education and below (1.7%), those in other occupations (29.1%) as compared to farmers and hunters (4.8%), and those who reside in urban communities (30.4%) as compared to those who reside in rural communities (3.1%) as shown in Table 3. Multivariate logistic regression analysis did not show any predictor of good knowledge of rabies prevention.

Respondents' Practices Regarding Rabies Prevention

Only about a quarter 47 (24.7%) of the 190 respondents had good rabies prevention practices. About a half and less of respondents observed the practices that reduce exposure to rabies infection such as restricting dog movement (48.4%), wearing protective equipment while handling dogs (16.3%), having their dog vaccinated in the past 1 year (28.4%), and reporting rabid or suspected rabid

dogs (35.8%). Majority 102 (53.7%) of the 190 respondents allow their family members to play with their dogs, and a few of them (9.5%) also allow their family members to play with stray dogs [Table 4].

Good practice of rabies prevention was associated with respondents' religion, education level, occupation, and place of residence. It was also associated with good knowledge of cause and transmission of rabies, as well as with good knowledge of rabies prevention. The proportion of respondents with good practice of rabies prevention was significantly ($P < 0.05$) higher among Christians (40.5%) as compared to Muslims (20.3%), those with secondary and tertiary education (22.4%) as compared to those with primary education and below (1.7%), those in other occupations (33.9%) as compared to hunters and farmers (6.9%), and those who reside in urban communities (32.0%) as compared to those who reside in rural communities (10.8%). Furthermore, the proportion of respondents with good practice of rabies prevention was significantly ($P < 0.05$) higher among respondents with good knowledge of cause and transmission of rabies (37.3%) as compared to those with poor knowledge (15.0%), and those with good knowledge of rabies prevention (67.5%) as compared to those with poor knowledge (13.3%) as shown in Table 5.

Table 4: Respondents' practices regarding rabies prevention

Variables	Frequency (%) *n*=190
Allow family members to play with their dogs	
Yes	102 (53.7)
No	72 (37.9)
Cannot recall	16 (8.4)
Wear personal protective equipment while handling dogs	
Yes	31 (16.3)
No	149 (78.4)
Cannot recall	10 (5.3)
Restrict dog movement	
Yes	92 (48.4)
No	95 (50.0)
Cannot recall	3 (1.6)
Allow family members to play with stray dogs	
Yes	18 (9.5)
No	152 (80.0)
Cannot recall	20 (10.5)
Vaccinated their dog(s) in the past 12 months	
Yes	54 (28.4)
No	130 (68.4)
Cannot recall	6 (3.2)
Reported rabid or suspected rabid dogs	
Yes	68 (35.8)
No	27 (14.2)
Never had a rabid or suspected rabid dog	95 (50.0)
Practice grade	
Good	47 (24.7)
Poor	143 (75.3)

In multivariate logistic regression analysis, the predictors of good rabies prevention practices among the respondents were their level of education and their knowledge of rabies prevention. Higher educational background (secondary and tertiary) and good knowledge of rabies prevention were associated with a 21.084-fold (adjusted odds ratio [aOR]: 21.084, 95% confidence interval [CI]: 1.160–383.081, $P = 0.0039$) and 26.395-fold [aOR: 26.395, 95% CI: 1.055 – 660.269, $P = 0.046$) greater likelihood of good rabies prevention practices, respectively [Table 6].

Pattern of Dog Bites among Respondents

Forty-five (23.7%) of the 190 respondents reported that either themselves or a member of their family have ever experienced a dog bite, with the total number of dog bite victims being 61. Forty-seven (77.1%) of the 61 victims were by bitten by their own dogs, while 14 (22.9%) were bitten by stray dogs, and majority 38 (62.3%) of the dog bite victims were children (aged 12 years and below) as shown in Table 7.

DISCUSSION

This study assessed the knowledge and practices regarding rabies prevention among dog owners in Sokoto Nigeria. The high level of awareness of rabies (86.6%) among the respondents in this study is not surprising considering the fact that the rabies virus is mostly transmitted by domestic dogs,[1] the prevalent human activities involving dogs in Nigeria,[10] and the severity of cases of the disease. This is supported by the finding of similarly high levels of awareness in studies conducted in other places where the disease is also endemic including Lagos Nigeria (88.6%),[2] and Nairobi, Kenya (86%).[23]

The finding of friends and neighbors being the main source of information on rabies among the respondents in this study (82.4%), as well as the abysmally low prevalence of previous training on rabies prevention among them (6.8%) is worrisome, in view of the high endemicity of the disease in studies conducted across Nigeria,[8,9] as it suggests poor public health response to the disease in Nigeria, particularly periodic enlightenment campaigns on the mass media. It is, therefore, not surprising that less than half of the respondents in this study (43.7%) had good knowledge of the cause and transmission of rabies, only a few (16.3%) had good knowledge of its symptoms and signs, and about a fifth (21.1%) had good knowledge of its prevention; as the sources through which they could

Table 5: Factors associated with good rabies prevention practices among the respondents

Variables	Rabies prevention practices (*n*=190)		Test of significance
	Good Frequency (%)	Poor Frequency (%)	
Age (years)			
<40	33 (22.1)	116 (77.9)	χ^2=2.768
40 and above	14 (35.0)	26 (65.0)	*P*=0.095
Sex			
Male	36 (22.4)	125 (77.6)	χ^2=3.200,
Female	11 (37.9)	18 (62.1)	*P*=0.074
Marital status			
Single, separated, and widowed	10 (18.2)	45 (81.8)	χ^2=1.787
Married	37 (27.4)	98 (72.6)	*P*=0.181
Tribe			
Hausa/Fulani	31 (21.8)	111 (78.2)	χ^2=2.549
Others	16 (33.3)	32 (67.7)	*P*=0.110
Religion			
Christianity	17 (40.5)*	25 (59.5)	χ^2=7.174
Islam	30 (20.3)	118 (79.7)	*P*=0.007
Level of education			
Primary and below	1 (1.7)	59 (98.3)	χ^2=12.513
Secondary and tertiary	17 (22.4)	59 (77.6)	*P*<0.001
Occupation			
Farmer/hunter	4 (6.3)	59 (93.7)	χ^2=17.117
Others	43 (33.9)*	84 (66.1)	*P*<0.001
Residence			
Rural	7 (10.8)	58 (89.2)	χ^2=10.353
Urban	40 (32.0)*	85 (68.0)	*P*=0.001
Knowledge of causes and transmission of rabies			
Good	31 (37.3)*	52 (62.7)	χ^2=12.593
Poor	16 (15.0)	91 (85.0)	*P*<0.001
Knowledge of symptoms or signs of rabies			
Good	5 (25.0)	15 (75.0)	χ^2=0.041
Poor	28 (27.2)	75 (72.8)	*P*=0.840
Knowledge of rabies prevention			
Good	27 (67.5)*	13 (32.5)	χ^2=49.766
Poor	20 (13.3)	130 (86.7)	*P*<0.001

*Statistically significant

Table 6: Predictors of good rabies prevention practices among the respondents

Variables	aOR	95% CI		*P* value
		Lower	Upper	
Age (below 40 vs. 40 years and above)	3.649	0.321	41.467	0.297
Sex (Males vs. females)	2.812	0.171	46.282	0.469
Marital status (married vs. single, separated, and widowed)	1.132	0.140	9.147	0.908
Tribe (Hausa/Fulani vs. other tribes)	0.577	0.027	12.493	0.726
Religion (Christianity vs. Islam)	1.499	0.108	20.753	0.763
Education (secondary and tertiary vs. primary and below)	21.084*	1.160	383.081	0.039
Occupation (others vs. farmers and hunters)	2.797	0.309	25.309	0.360
Residence (urban vs. rural)	1.231	0.099	15.326	0.872
Knowledge of cause and transmission of rabies (good vs. poor)	3.406	0.592	19.600	0.170
Knowledge of symptoms or signs of rabies (good vs. poor)	4.171	0.316	55.194	0.278
Knowledge of rabies prevention (good vs. poor)	26.395*	1.055	660.269	0.046

*Statistically significant. CI: Confidence interval. aOR: Adjusted odds ratio

have obtained accurate information about the disease were apparently non-functional.

The association between good knowledge of the cause and transmission of rabies and the respondents' tribe and place of residence with a significantly higher proportion of those from other tribes and Christians having good knowledge as compared to the Hausa/Fulani and Muslims could be due to the fact that they were mostly urban residents with better access to education as well as diverse sources of information about the disease. This is supported by the submissions of Odeh *et al*.,[10] on educated people having better access to media and internet. Similar findings were also reported in studies conducted in other cities in Nigeria.[12,18]

Table 7: Pattern of dog bites among respondents

Variables	Frequency (%)
Self or family members ever experienced a dog bite (*n*=190)	
Yes	45 (23.7)
No	145 (76.3)
(Total number of cases of dog bites=61)	
Type of dogs the responsible for the bites (*n*=61)	
Own dog	47 (77.1)
Stray dog	14 (22.9)
Age of dog bite victims (years) (*n*=61)	
1-5	11 (18.0)
6-12	27 (44.3)
13-17	14 (23.0)
18 and above	9 (14.8)

Whereas, the associations obtained in the distribution of respondents with good knowledge of rabies prevention in this study correlates perfectly with that of the distribution of their knowledge of the cause and transmission of the disease, with the proportion of those with good knowledge of both the symptoms and signs, and prevention of the disease, being significantly higher among the respondents from other tribes as compared to Hausa / Fulani, and among urban residents as compared to rural residents, the reverse is true of the associations obtained in the distribution of respondents with good knowledge of the symptoms and signs of the disease. A significantly higher proportion of Hausa / Fulani, farmers/hunters, and rural residents had good knowledge of the symptoms and signs of the disease as compared to those from other tribes, those in other occupations and urban residents.

The association between good knowledge of symptoms or signs of rabies and being Hausa/Fulani and rural residents among the respondents in this study could be a confounding effect of their occupation (farming/hunting) which exposes them to frequent contact with these animals with the resultant effect of development of familiarity with normal and abnormal behaviors and signs of illness in dogs. This finding is in agreement with the finding in a study conducted in Zaria and Kafanchan,[10] that reported significantly higher knowledge of symptoms of rabies among rural as compared to urban residents, and occupation was also believed to be a confounding factor in that association, as the farmers/hunters were mostly resident in the rural areas.

Of serious concern is the low proportion of respondents with good practice of rabies prevention in this study (24.7%) and the high proportion of those that were engaged in practices that expose them and members of their households to rabies infection including allowing their family members to play with their dogs (53.7%), handling dogs without wearing personal protective equipment (78.4%), not restricting dogs movement (50.0%), and the low vaccination coverage for their dogs (28.4%) in view of the substantial number of cases of dog bites among members of their households, and with majority of the victims (62.3%) being children aged 12 years and below. While the higher prevalence of dog bites among children in this study corroborates the WHO estimates of about 40% of people who are bitten by suspect rabid animals being children under 15 years of age,[1] it also underlines the need for government and other stakeholders to step up education of the public, especially dog owners, on rabies prevention, by organizing periodic awareness campaigns through the mass media. In addition, government should organize annual free or subsidized mass dog vaccination campaigns, as it has been identified as the most effective measure to control rabies and prevent human deaths.[13]

CONCLUSION

Although majority of the respondents in this study were aware of rabies, they had low knowledge of the cause and transmission, signs and symptoms, and prevention of the disease. Furthermore, the respondents' rabies prevention practices were poor, and dog bites were prevalent in their households, with majority of the victims being children. Government and other stakeholders should step up education of the public especially dog owners on rabies prevention, in addition to organizing annual free or subsidized mass dog vaccination campaigns.

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