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Dog rabies in the western region of Ghana: Survey of knowledge, attitudes, practices and perceptions

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Abstract

Background: Rabies is endemic in Ghana. However, published information on rabies is limited. This study, the first to report on the knowledge, attitudes, practices and perceptions (KAPP) on rabies in Ghana aims at determining the level of these for rabies management and control in 3 districts of the Western Region of Ghana. This would make available baseline data that identify gaps affecting rabies control and prevention practices while providing information for public (mass) communication, control and prevention of rabies targeting both the animal source and the human population-at-risk.

Methods: The study design was cross-sectional with face-to-face interviews using structured questionnaire. In all, 505 questionnaires were administered. Data on dog bites and rabies cases in Western Region from 2014 to 2018 were also analysed.

Results: There were significant differences in the 3 districts in the levels of education of respondents (χ^2=17.04; p=0.008); use of dogs as companions/pets (χ^2=10.31; p=0.006) and for security (χ^2=97.06; p=0.000); and proportion of respondents who had or had not heard of rabies (χ^2=22.14; p=0.000). For KAPP, significant differences were seen in the 3 districts for the following: proportions who said that a bite from rabid dog could transmit rabies (χ^2=9.32; p=0.009); paralysis of tail was a sign of rabies (χ^2=9.07; p=0.009); rabies can be transmitted by other animals (χ^2=10.48; p=0.033); rabies can be treated by traditional healers (χ^2=22.67; p=0.000); local treatment was available for dog bites and rabies (χ^2=10.74; p=0.030); believe it is good to vaccinate their dogs (χ^2=6.64; p=0.040); cost of vaccination was affordable (χ^2=13.23; p=0.010); dogs should be allowed to roam freely in community (χ^2=12.68; p=0.007); and controlling dog population was important (χ^2=12.98; p=0.011).

Conclusion: These findings provide information that should be considered in the design and implementation of programmes to successfully control and prevent rabies in the study area.

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Introduction

According to World Health Organization (WHO), each year an estimated 50,000 to 60,000 people die from rabies, mostly children with terrible suffering; a much higher number of domestic animals are also affected. Rabies remains a permanent health threat to the human population. Rabies is a neglected fatal viral zoonotic disease. In some parts of the world, it is considered a re-emerging zoonotic disease after being absent in humans for a time [1,2]. It affects mainly low- and middle-income countries. Domestic dogs are the main vectors of the disease causing 94% of human rabies through bites [3]. Rabies is endemic in Ghana where the prevalence of the disease hinges on the density of unvaccinated dog populations. The public health burden of rabies can be attributed to the financial cost for disease control. There is lack of credible data on rabies to evaluate its impact on human and animal populations and to obtain commitment and support from national authorities in the implementation of preventive and control programmes [4], especially in low-income countries leading to low prioritisation of the disease and to its neglect [5,6].

Rabies is under-reported in many countries [7] including Ghana. Available data on rabies is inadequate due to poor reporting systems on the disease. Inefficient annual mass vaccination schedules, low vaccine coverage, poor quarantine regulations and inadequate stray dogs and weak or non-existent wildlife rabies prevention programmes increase animal transmission of the disease. There is insufficient monitoring of human rabies outbreaks in Ghana due to poor coordination between the Veterinary Services Directorate (VSD), the Ministry of Health (MoH) and Ghana Health Services (GHS). Evaluation of animal outbreaks in Ghana is almost non-existent, and these outbreaks are unfortunately associated with outbreaks in humans [8]. From 2000 to 2004, 123 clinically-confirmed human cases were reported [9]. It is believed that most rabies cases are not reported due to a lack of surveillance and poor laboratory infrastructure, as well as some cultural and social reasons [9].

Published information about rabies in humans and dogs, and dog bites in the Western Region of Ghana is either non-existent or not available. There have been published reports about the situation in the Greater Accra Region [8-11], rural Ghana [12], the Eastern Region [13], Manya Krobo in the Eastern Region [14], Accra [15,16], Techiman in Brong-Ahafo Region [17] and Ghana as a whole [18]. It has been noted that a lack of reliable data and systematic analysis of available data continue to make rabies a neglected disease in Ghana [13].

Understanding the knowledge, attitudes and perceptions of rabies in communities is important because these influence post-exposure treatment seeking-behaviour [19] and help seek community support for rabies prevention and control programmes and measures [19,20]. Our study aimed at determining the level of knowledge, attitudes, perceptions and practices of rabies management and control in 3 districts of the Western Region of Ghana. This was to gather baseline data to identify gaps that may be affecting rabies control and prevention practices in these areas and to provide information for public (mass) communication, control and prevention of rabies targeting both the animal source and the human population-at-risk.

Methods

Study design and site

A cross-sectional study design was adopted and face-to-face interviews were conducted using a structured questionnaire to obtain data from respondents. This qualitative survey assessed knowledge, attitudes, perceptions and practices (KAPP) of rabies among residents of the Sekondi Takoradi Metropolitan Assembly (STMA), Effia – Kwesimintsim Municipal Assembly (EKMA) and the Shama district in the Western Region of Ghana as shown in Figure 1. The Sekondi-Takoradi Metropolitan Assembly in Figure 1 is now divided into Sekondi Takoradi Metropolitan Assembly and Effia – Kwesimintsim Municipal Assembly.

The human population in STMA (combination of STMA and EKMA) in 2014 was 404,021 while that of Shama was 81,968 with population densities of 1847/square km and 379/square km [21], respectively. The proportions of the population who had never been to school were 10% for STMA and 24% for Shama while the proportions completing primary school were 21% and 28%, respectively [21]. The proportions of the population in severe poverty were 3.1% and 24%, respectively [21]. This may have a bearing on the ability to pay for services; for example, fee for dog rabies vaccination.

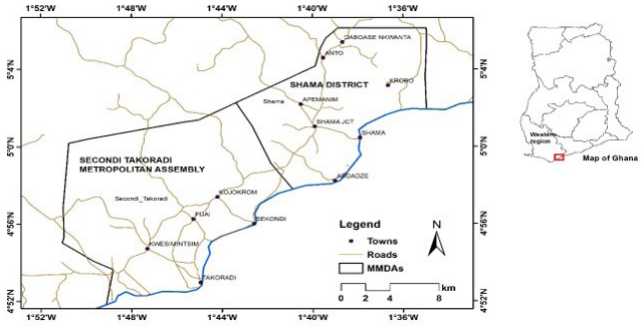

Figure 1: A map of the study area.

Questionnaire design

A questionnaire on KAPP of rabies was designed and administered to collect data. The questionnaire was adopted and adapted in part from similar studies conducted elsewhere [22,23]. It consisted of closed and open-ended questions in 4 parts: those about the respondent and socio-demographic information; questions related to knowledge and perception of rabies; questions related to attitudes and rabies control activities; and questions on pet care practices. The questionnaire was pre-tested using 5 respondents to improve clarity and interpretation of its content. Each respondent was taken through the questionnaire and where statements were not clear, understood or well-presented, these were altered.

Sample size determination

The minimum sample size required for residents representing households to be interviewed was estimated assuming that 50% of the population knew about rabies, since there was no evidence that an awareness study on rabies had been done before in the study area. The sample size was calculated as per formula given by Thrusfield [24] using 95% confidence interval and 0.05 absolute precision. The relevant formula is as follows:

$$n = [1.96^2 P_{exp} (1 - P_{exp})]/d^2$$

where n = required sample size

P_{exp} = expected prevalence

d = desired absolute precision

The calculated minimum sample size was 385 but in all 505

questionnaires were administered distributed as follows: STMA 179; EKMA 176 and Shama 150.

Data collection and statistical analysis

Records on dog bites, rabies cases, dog vaccinations and dog brain examinations were obtained from the offices of VSD and Ghana Health Services in the Western Region. These were summarized and where appropriate represented as a graph.

Individuals were selected purposively and by convenience in the absence of a reliable sampling frame or list. Any available household member who voluntarily accepted to be interviewed was chosen. On getting into a residential area, a first household was chosen and a resident interviewed. This was followed by choosing the next nearest household in a "snowball" manner until the targeted number of respondents was selected. The questionnaire was administered in a language understood by the respondent which were either English, Fante or Twi languages. On average it took respondents about one hour to complete the questionnaire. Data were collected from June – August, 2018, coded manually and entered into Microsoft Excel 2016 (Microsoft Corp., Redmond, Washington, USA) with analyses being carried out using SPSS software version 23 (SPSS Inc. Chicago, Illinois, USA). The Chi-square test and Fishers Test were used, where appropriate, to evaluate the statistical significance in differences in respondent proportions from the three districts. A p-value of < 0.05 was considered statistically significant. Cross tabulations were also done between certain parameters.

Ethical considerations

Informed verbal consent was obtained from each respondent before administering the questionnaire. The data was anonymized for confidentiality and no record could be traced to the individual. Permission for the study were obtained from regional offices of the Ghana Health Services and Veterinary Services Directorate in the Western Region.

Limitation of the Study

The major limitation of the study was the difficulty in random selection of respondents due to the unplanned distribution of houses in the study area resulting in the use of the snowball method of selection. Also, there was an over-representation of tertiary students in the study compared to their proportion in the population because of hostel facilities in two of the study areas.

Results & discussion

Dog bites, rabies cases and vaccination in Western Region

Table 1 shows data on dog bites and rabies cases in Western Region from 2014 to 2018.

The dog bite cases reported by MoH and VSD were very similar. However, Adomako et al [13] noted that parallel and uncoordinated systems of rabies surveillance maintained separately by the health and veterinary services resulted in gross disparities between the numbers of reports events and an overall impression of underreporting. Further, GHS and VSD operated independent systems of zoonotic disease reporting, collected very different sets of information and did not have a common platform for data sharing and reconciliation. This needs to be addressed to ensure better disease information collection, management and dissemination.

Dogs suspected of having rabies on dying have their brains examined microscopically for the presence of Negri bodies by Seller's stain test in the laboratory. Table 2 gives the results of examinations in the Western Regional Veterinary Laboratory from 2010 to 2018. The positives were quite low in number. In contrast, Lopes and others [11] reported 91.6% (283/309) positive animal samples in Greater Accra Region for the period 2006 to 2011. This calls for further improvement in the skills and/or equipment for rabies detection in the Western Region. Seller's stain test has low sensitivity compared with a direct Fluorescent Antibody Test [25].

Table 1: Dog bites and rabies cases in 3 districts and in Western Region from 2014 to 2018

Year	Dog rabies cases in STMA and EKMA	Dog rabies cases in Shama	Dog bite cases (MoH)	Dog bite cases (VSD)
2014	276	32	1368	1369
2015	502	56	2007	2010
2016	482	26	1921	1922
2017	456	65	2208	2209
2018	195	29	NA	2131

Notes: STMA: Sekondi-Takoradi Metropolitan Assembly; EKMA: Effia-Kumah Metropolitan Assembly; MoH: Ministry of Health; VSD: Veterinary Services Directorate; NA: Not Available

Table 2: Laboratory confirmation of rabies cases in Western Region from 2010 to 2018

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018
Suspected	56	48	55	62	40	59	56	195	11
Positive	4	4	2	0	1	1	1	14	6

Rabies control is through the vaccination of dogs annually. Figure 2 presents a graph of dog vaccinations in Western Region from 2009 to 2017.

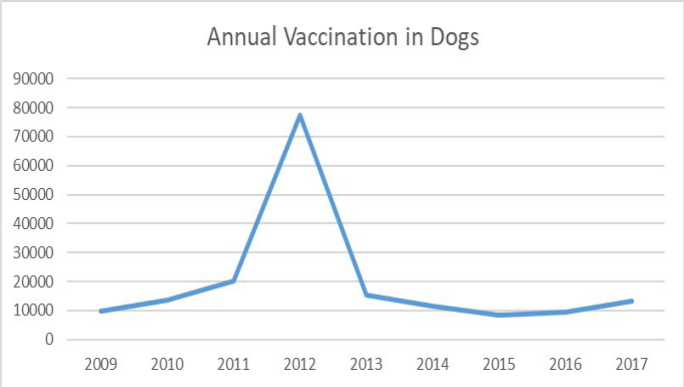

Figure 2: Annual Rabies vaccination in dogs in Western Region of Ghana.

In general, the annual vaccinations were around 10,000 dogs except for 2012 when about 77,000 dogs were vaccinated. The hike in 2012 was due to a concerted vaccination campaign. The rabies vaccination coverage in 2008 was 11.6% (9863 dogs vaccinated out of a dog population of 84,713). This was very low compared to the 70% annual vaccination coverage recommended for effective rabies control [26-28]. A similar low annual dog vaccination coverage of 10.3% to 17.6% has been reported for the Greater Accra Region [11]. The "owner-pay policy" for dog vaccinations has been identified as a major reason for such low patronage [11]. Further, the imposition of user cost and lack of prioritisation is said to have contributed to unsustainable mass dog vaccination programmes in many sub-Saharan African countries [13]. Punguyire and others [17] noted that although routine vaccination campaigns were organised annually for pet owners in Techiman in Brong Ahafo Region of Ghana, the patronage was poor because there was and is no enforceable policy of pet vaccination. Also, low awareness of the dangers of rabies among people make it unattractive for pet owners to vaccinate their dogs. The same may be true in the districts surveyed in the Western Region.

Background information of respondents

Table 3 provides background information for the respondents. The majority of respondents (61.8%) were male and 38.2% were female. In terms of education, the majority had reached tertiary level education (46.7%), this does not reflect the situation in Ghana and might have introduced some bias in the findings. There were more student respondents (27.1%) and may explain the predominance of respondents with tertiary and secondary education (76% in total) in the survey.

Most (93%) of the respondents were Christians. The predominant age group was the 20-29 year olds who formed 35 to 41% of the respondents in the 3 districts and an overall of 38%. The mean age for the respondents were 32.8 ± 14.9 years, with a range of 11- 86 years for STMA 33.6 ± 13.3 years; with a range of 12-68 years for EKMA, and 33.1 ± 13.7 years; with a range of 10-71 years for Shama. There was no significant differences in the three districts.

The mean number of dogs owned was 2.0 ± 1.2 for STMA, 1.7 ± 0.8 for EKMA and 1.8 ± 0.6 for Shama; similar to the 2.3 and 2.1 dogs per household in Bauchi State, Nigeria [29] and in Machakos District, Kenya [30], respectively. The majority of respondents owned the dogs either as pets/companions or for security purposes. In Shama, 82.4% of respondents kept dogs for security reasons pointing to a greater need for protection against theft in the rural areas. A major reason for keeping dogs was in providing security for household, livestock and farm crops in Nigeria [29], Zimbabwe [31], Zambia [32], Chad [33] and Madagascar [34]. In Tanzania, 78% of respondents kept dogs for security [35].

About 35% of the respondents kept their dogs in cages but allowed them to roam sometimes mostly at night on guard duties. In contrast, 65% of dog owners in Abuja, Nigeria housed their dogs in kennels, but sometimes allowed them free-roaming within the compound [36]. About a third (32%) of respondents in STMA allowed their dogs to roam unhindered at all times which may attack humans leading to dog bites, and if infected with rabies humans may become infected. It is reported that more than 90% of human cases are from dogs with 99% being free-roaming dogs and 99% of human rabies deaths emanating from rabid dogs [37].

Proportion of respondents who said they had been bitten by a dog before was 18.2%, far lower than 41% reported in Gondar, Ethiopia [38], 42% in Addis Ababa [39], and 61% in Bahir Dar, Ethiopia [40], but close to 13% reported in Kwazulu Natal, South Africa [41].

A high proportion of respondents (81.2%) had heard of rabies, similar to 89% reported in Cameroon [42], 86% in Kwazulu Natal [41] and 99% in Ethiopia [43]. About 51% of the respondents cited school and mass media as sources of information on rabies, in contrast to findings from Tanzania where 70% of respondents cited neighbours, friends, and parents as the most common source of information about rabies [35].

Only 34% had vaccinated their dogs against rabies; this value is quite low considering that a vaccination coverage of at least 70% is recommended by WHO for effective control of rabies [44]. Similar low vaccination coverage was reported in Bauchi State, Nigeria, with explanation that such low coverage was insufficient to control the spread of rabies and was also indicative of a lack of awareness amongst the general public of the dangers posed by unvaccinated dogs [29]. Only about 24.1% (n = 399) had a vaccination booklet as evidence of having their dogs vaccinated. In Sri Lanka, although 76% of respondents claimed to have vaccinated their dogs, only 41% were able to show their pet vaccination booklet [22]. In Abuja, Nigeria, 94% of respondents said their dogs were vaccinated against rabies and 86% were able to produce evidence of vaccination [36]. A cross tabulation of responses regarding having vaccinated their dogs and having a vaccination booklet in our study was significant (χ^2 = 223, p≤0.001, Table 5).

Knowledge, attitude, practices and perceptions on rabies

Table 4 gives the distribution of responses on knowledge, attitudes, practices and perceptions on rabies. Most (96%) of the respondents associated dogs with rabies. Dogs are responsible for more than 90% of all human cases worldwide [44]. In Ethiopia 86% of respondents identified dogs as the most common source of rabies [45]. About a third of the respondents in our study identified cats as being associated with rabies. A recent report of dog rabies in a pig in the Volta Region of Ghana should lead to concerns about transmission of rabies by other animal species [46]. The finding that fewer respondents knew that other animal species apart from domestic dogs transmitted rabies were consistent with findings from Tanzania [35] and Thailand [47].

The majority (93.1%) of respondents were aware that a bite from rabid dog was a mode of rabies transmission. It has been

reported that 99% of rabies cases resulted from the bite of rabid dog [48-50], 94% in Gondar Zuria in Ethiopia [38] and 81% in Tanzania [35]. Other modes such as contact with saliva from rabid dogs with open wounds (43.9%), scratches from rabid dog (32.6%) and inhalation of virus in closed environments (8.8%) were less known by respondents in our study.

Proportions of respondents that identified various signs of rabies ranged from as low as 11% for paralysis of tails, to as high as 64% for aggression/biting without provocation (Table 4). Aggression was identified as a major clinical sign in rabid animals by 63.5% of respondents in Gondar Ethiopia [38]. It was worrying to note that salivation (40.4%) and foaming in the mouth (37.7%) which are more visible were less known by the respondents. Digafe and others noted that the furious form of rabies identified by aggression was the more recognizable clinical form by most people, attracting individual's attention because the animals tend to attack humans and other animals [38]. The paralytic form could be easily overlooked by the community since it may not be noticed by those who associate rabies only with "madness" shown as aggression. Under such conditions, post exposure prophylaxis may not be sought on exposure to animals with the paralytic form of rabies, risking death by rabies [38]. Hydrophobia, which is a pathognomonic sign for dog rabies, was mentioned by 14.5% of the respondents. A significantly higher proportion of respondents from STMA (43.1%) compared to those from EKMA (29.9%) and Shama (26.7%) identified aimless roaming or escaping from the home as a sign of rabies in dogs.

A high proportion of respondents (mean 71%; range 67% - 75%) identified a visit to the nearest health facility for treatment as an action to be taken immediately after a bite by a rabid dog. This is lower than the 83% recorded in Tanzania [35]. Washing the site of bite with soap and water was identified by 25.2% of the respondents, close to the 31% reported in Ethiopia [38]. It has been reported that washing wounds (which may be rabies infected) with soap and water was the best first aid to prevent rabies [51] and that this is a cheap, readily available and feasible option for everyone to apply [38]. In Ethiopia, 76% of respondents said the immediate action to taken after a bite was to wash with water and soap [45]. Most of the respondents (93.4%) in our study identified seeking help from a health facility as an action to be taken immediately. The WHO recommends that wounds should be cleaned and persons given post-exposure prophylaxis a few hours after contact with a suspected rabid animal to prevent onset of rabies and death [52].

Very high proportions of respondents said rabies can be transmitted from animals to man (93%), and can be prevented by vaccination of dogs (89%). About 52% did not believe that rabies is transmitted by dogs only, while 52.9% said it can be transmitted by other animals. About 54% of respondents did not think that rabies can be treated by traditional healers. In Ethiopia as high as 58% [53] and 84% [54] relied on traditional treatment putting people at risk. In Shama, 27.2% said rabies could be treated by traditional healers raising concerns. The role of traditional healers in the "treatment" of rabies needs to be examined further. A cross tabulation of answers to questions on rabies being treated by traditional means and there being locally available methods to treat dog bite and rabies was significant (χ^2 value of 61.9, p≤0.001, Table 5).

Very high proportions of respondents would report to hospital for treatment if bitten by a stray dog (95.9%), if bitten by their own dog (94.6%), if bitten by a vaccinated dog (82.4%) or if bitten by wild animals (94.9%), suggesting that the respondents would not risk having rabies through a dog bite. In Abuja, Nigeria, 87% of respondents would seek help in a hospital when bitten by a dog [36]. In our study about 47% believed rabies can be treated after onset of clinical signs in man. This is incorrect so educative messages should be put out to dispel this belief. A similar finding was reported from Abuja, Nigeria where 54% of respondents said rabies could be cured after the appearance of symptoms [36]. As high as 65% did not think that information/education about rabies in Ghana was adequate (Table 4). Efforts would have to be made to provide innovative, and informative messages for public education about rabies.

Almost all (98.5%) of respondents believed it was good to vaccinate dogs and that rabies can be controlled by vaccination (89.4%). Kayali and others have argued that canine rabies (and by extension human exposure to rabies) can be controlled through mass vaccination of the animal reservoirs if dog owners were willing to and cooperated in measures designed for this [20,55]. They noted that inaccessible and ownerless dogs reduce the vaccination coverage needed to be achieved in parenteral campaigns to control the disease. Although 43.4% of the respondents (ranging from 29% in Shama to 50.3% in STMA) said the cost of vaccination was affordable, the majority (88.4%, ranging from 84.7% in STMA to 91.3% in Shama) thought the fee for vaccination was reasonable. A service charge of 10 – 15 Ghanaian cedis (2 – 3 US dollars) per dog is charged for rabies vaccination. In West Africa, a fee charge of US$1.45 resulted in a much lower vaccination coverage of 28% compared to an earlier free vaccination coverage of 68-87% [56]. The cost of vaccination has importance and influences vaccination coverage [57]. Cross tabulation of cost being affordable and reasonable was significant (χ^2 = 6.3, p= 0.010, Table 5)

Table 5 presents results for cross tabulations of parameters with significant p-values (p<0.05). Cross tabulations allow an understanding of association between variables.

Table 3: Background information on respondents in 3 districts of Western Region, Ghana.

Variable	Total		STMA		EKMA		Shama		χ^2 value	p
	n	%	n	%	n	%	n	%		
Number of respondents	505	100	179	35.4	176	34.9	150	29.7		
Sex										
Male	312	61.8	109	60.9	118	67.0	85	56.7	3.79	0.151
Female	193	38.2	70	39.1	58	33.0	65	43.3		
Level of Education										

Tertiary	236	46.7	59	49.7	81	51.7	56	37.3		
Secondary/High School	147	29.1	49	27.4	56	31.8	42	28.0	17.04[a]	**0.008**
Primary/Basic	107	21.2	34	19.0	26	14.8	47	31.3		
No formal education	15	3.0	7	3.9	3	1.7	5	3.3		
Religion										
Christian	472	93.5	168	93.8	164	93.2	140	93.3		
Moslem	26	5.1	10	5.6	10	5.7	6	4.0	3.79[a]	0.764
Traditional	3	0.6	0	0	1	0.6	2	1.3		
Others	4	0.8	1	0.6	1	0.6	2	1.3		
Occupation										
Student	137	27.1	55	30.7	41	23.3	41	27.3		
Others	106	21.0	32	17.9	45	25.6	29	19.3		
Self employed	94	18.6	29	16.2	37	21.0	28	18.7	11.51	0.319
Government employee	64	12.7	30	16.8	19	10.8	15	10.0		
Trader/Business person	59	11.7	20	11.2	18	10.2	21	14.0		
Unemployed	45	8.9	13	7.3	16	9.1	16	10.7		
Age	500		176		174		150			
10-19	69	13.8	33	18.7	18	10.4	18	12.0		
20-29	189	37.8	62	35.2	55	37.4	52	41.3		
30-39	101	20.2	35	19.9	42	24.2	24	16.0	26.38	0.154
40-49	60	12.0	17	9.6	20	11.4	23	15.3		
50-59	50	10.0	18	10.2	15	8.6	17	11.3		
60+	31	6.2	11	6.2	14	8.0	6	4.0		
Numbers of dogs owned	505		179		176		150			
0	258	51.1	86	48.0	82	46.6	85	56.7		
1	94	18.6	33	18.4	39	22.2	22	14.7		
2,3,4	124	24.6	45	25.1	43	24.4	36	24.0	7.94[a]	0.436
5,6,7,8,9	21	4.2	8	4.5	7	4.0	6	4.0		
10 and more	13	2.6	7	3.9	5	2.8	1	0.7		
Dogs used for	501									
Pet/companion	265	52.9	105	58.7	75	43.1	85	57.4	10.31	**0.006**
Security	243	48.5	59	33.0	62	35.6	122	82.4	97.06	**0.000**
Exercising or walking	110	22.0	40	22.3	37	21.3	33	22.3	0.08	0.971
Recreation	92	18.4	35	18.6	23	13.2	34	23.0	5.34	0.070
Breeding business	66	13.6	17	9.6	26	14.9	25	16.9	4.20	0.124
Food/Meat	38	7.6	8	4.5	12	6.9	18	12.2	6.95	**0.031**
Hunting	35	7.0	11	6.1	10	5.7	14	9.5	2.00	0.374
Herding livestock	14	2.8	8	4.6	5	2.9	1	0.7	4.36	0.114
Other reasons	14	2.8	4	2.2	7	4.0	3	2.0	1.49[a]	0.556
Housing of dogs	468									

Caged but free to roam sometimes	162	34.6	55	32.2	59	36.4	48	35.6		
Free to roam at all times	111	23.7	54	31.6	28	17.3	29	21.5		
Tied in house compound	87	18.6	26	15.2	34	21.0	27	20.0	12.12	0.146
Always in cages	55	11.8	21	12.3	21	13.0	13	9.6		
Live inside house	53	11.3	15	8.8	20	12.3	18	13.3		
Bitten by dog	500		179		174		147			
Yes	91	18.2	32	17.9	32	18.4	27	18.4	0.20	1.00
No	409	81.8	147	82.1	142	81.6	120	81.6		
Heard of rabies	505									
Yes	410	81.2	153	85.5	154	87.5	103	68.7	22.14	**0.000**
No	95	18.8	26	14.5	22	12.5	47	31.3		
"Yes "as Sources of rabies information										
School	210	51.2	90	58.8	61	39.6	59	57.3	13.36	**0.001**
Mass media	208	50.7	80	52.3	80	51.9	48	46.6	0.94	0.641
Face to face chats	131	32.0	45	29.6	52	33.8	34	33.0	0.67	0.704
Newspaper/magazine	87	21.2	39	25.5	26	16.9	22	21.4	3.40	0.189
Social media	66	16.2	26	17.1	23	15.0	17	16.5	0.25	0.899
Internet	65	15.9	22	14.5	24	15.6	19	18.4	0.74	0.601
Others	38	9.3	11	7.2	14	9.1	13	12.6	2.12	0.350
Own a dog	405		153		154		98			
Yes	208	51.4	81	52.9	81	52.6	46	46.9	1.01	0.609
No	197	48.6	72	47.1	73	47.4	52	53.1		
Vaccinated dog against rabies	403		153		153		97			
Yes	137	34.0	56	36.6	58	37.9	23	23.7	6.08	0.047
No	266	66.0	97	63.4	95	62.1	74	76.3		
Vaccination year	361		150		142		69			
2018	50	13.9	22	14.7	21	14.8	7	10.1		
2017	42	11.6	21	14.0	17	12.0	4	5.8		
2016	14	3.9	6	4.0	4	2.8	4	5.8		
2015	7	1.9	3	2.0	0	0.0	4	5.8		
2014	1	0.3	0	0.0	1	0.7	0	0.0		
Not done	247	68.4	98	65.3	99	69.7	50	72.5		
Has vaccination booklet	399		150		152		97			
Yes	96	24.1	40	26.7	39	25.7	17	17.5	3.04	0.222
No	303	75.9	110	73.3	113	74.3	80	82.5		

Notes: [a]:Fisher Test value; All others are Pearson Chi Square values; Boldened p-value: Significant ($p<0.05$); STMA: Sekondi Takoradi Metropolitan Area;EKMA: Effia Kuma Municipal Area.

Table 4: Knowledge, Attitudes, Practices and Perceptions on Rabies in study area.

Variable	Total		STMA		EKMA		Shama		χ^2 value	p
Species associated with rabies	408		153		154		101			
Dogs	391	95.8	147	96.1	146	94.8	98	97.03	0.791	0.670
Cats	136	33.3	51	33.3	56	36.4	29	28.7	1.61	0.456

Bats	73	17.9	31	20.3	29	18.8	13	12.9	2.41	0.293
Cattle	35	8.6	10	6.5	10	6.5	6	5.9	4.49	0.116
Unknown	11	2.7	1	0.6	8	5.2	2	2.0	6.60	**0.044**
Rabies transmission	406		153		153		100			
Bite from rabid dog	378	93.1	150	98.0	138	90.2	90	90.0	9.32	**0.009**
Contact with saliva from rabid dog to open wound	179	43.9	66	43.1	69	45.1	44	44.0	0.09	0.967
Scratching by rabid dog	133	32.6	46	30.1	52	34.0	35	35.0	0.74	0.686
Inhalation of virus in enclosed area	36	8.8	12	7.8	13	8.5	11	11.0	0.75	0.736
Does not know	14	3.4	1	0.7	5	3.3	8	8.0	9.72	**0.007**
Signs of rabies										
Aggression/biting without provocation	259	63.5	99	64.7	98	63.6	62	61.4	0.29	0.859
Salivation	165	40.4	64	41.8	57	37.0	44	43.6	1.28	0.529
Restlessness	160	39.2	65	42.5	63	40.9	32	31.7	3.27	0.194
Foaming at the mouth	154	37.7	58	37.9	52	33.8	44	43.6	2.49	0.293
Aimless roaming/escape from home	139	34.1	66	43.1	46	29.9	27	26.7	9.23	**0.010**
Biting imaginary objects	122	29.9	49	32.0	43	27.9	30	29.7	0.62	0.736
Fearlessness/loss of fear	105	25.7	39	25.5	43	27.9	23	22.8	0.84	0.655
Off feed/refusal to eat	104	25.6	40	26.1	34	22.1	30	29.7	2.05	0.373
Change in voice	95	23.3	37	24.2	36	23.4	22	21.8	0.20	0.912
Growling	89	21.8	38	24.8	33	21.4	18	17.8	1.78	0.427
Staring look	71	17.4	30	19.6	27	17.5	14	13.9	1.40	0.501
Paralysis of mouth	70	17.2	27	17.6	23	14.9	20	19.8	1.01	0.619
Does not know	65	16.2	21	13.7	27	17.5	17	16.8	0.88	0.649
Hydrophobia	59	14.5	17	11.1	21	13.6	21	20.8	4.74	0.093
Unconscious	52	12.7	21	13.7	16	10.4	15	14.9	1.30	0.503
Paralysis of tail	45	11.0	24	15.7	8	5.2	13	12.9	9.07	**0.009**
Actions to be taken immediately after bite by suspected rabid dog										
Visit nearest health facility for treatment	290	71.1	102	66.7	112	72.7	76	75.2		
Wash site with soap and water	97	25.2	45	29.4	36	23.4	16	15.8		
Don't know	13	3.2	5	3.3	2	1.3	6	5.9	12.45	0.078
Do nothing	6	1.5	1	0.7	3	1.9	2	2.0		
See traditional healer for help	2	0.5	0	0.0	1	0.6	1	1.0		
How soon to seek help from health facility										
Immediately	382	93.4	145	94.8	143	93.5	94	91.3		
Within a week	8	2.0	3	2.0	3	2.0	2	1.9		
Don't know	8	2.0	2	1.3	4	2.6	2	1.9	7.70	0.344
When signs of illness start	6	1.5	3	2.0	0	0.0	3	2.9		
Within one month	5	1.2	0	0.0	3	2.0	2	1.9		
Rabies can be transmitted from animals to man										
Yes	377	93	143	93.5	141	91.6	93	90.3		
No	7	1.7	3	2.0	1	0.6	3	2.9	3.47	0.484
Don't know	26	6.3	7	4.6	12	7.8	7	6.8		

Rabies can be prevented by dog vaccination										
Yes	365	89	134	87.6	140	90.9	91	88.3	3.23[a]	0.521
No	19	4.6	10	6.5	6	3.9	3	2.9		
Don't know	26	6.3	9	5.9	8	5.2	9	8.7		
Believe that rabies is transmitted by dog only										
Yes	130	31.8	53	34.6	43	27.9	34	33.0	5.86	0.210
No	211	51.6	77	50.3	88	57.1	46	44.7		
Don't know	68	16.6	23	15.0	22	14.3	23	22.3		
Believe that rabies is transmitted by dog bite only										
Yes	176	43.0	60	39.5	66	42.9	50	48.5	4.70	0.320
No	194	47.4	81	53.3	70	45.5	43	41.7		
Don't know	39	9.5	11	7.2	18	11.7	10	9.7		
Rabies can be transmitted by other animals										
Yes	217	52.9	78	51.3	90	58.4	49	47.6	10.48	**0.033**
No	91	22.2	44	28.9	23	14.9	24	23.3		
Don't know	102	24.9	31	20.4	41	26.6	30	29.1		
Rabies can be transmitted through contact (broken skin) with saliva of rabid dog										
Yes	234	57.2	92	60.5	87	56.5	55	53.4	7.17	0.127
No	74	18.1	33	21.7	24	15.6	17	16.5		
Don't know	101	24.7	27	17.8	43	27.9	31	30.1		
Bite wounds should be washed with soap and water										
Yes	169	41.2	71	46.4	67	43.5	31	30.1	11.46	**0.022**
No	140	34.1	54	35.3	50	32.5	36	35.0		
Don't know	101	24.6	28	18.3	37	24.0	36	35.0		
Rabies can be treated by traditional healers										
Yes	64	15.6	20	13.1	16	10.4	28	27.2	22.67	**0.000**
No	222	54.1	91	59.5	94	61.0	37	35.9		
Don't know	124	30.2	42	27.5	44	28.6	38	36.9		
Locally available treatment for dog bites and rabies										
Yes	91	22.2	36	23.5	23	15.0	32	31.1	10.74	**0.030**
No	147	35.9	52	34.0	65	42.5	30	29.1		
Don't know	171	41.8	65	42.5	65	42.5	41	39.8		
Will report to hospital for treatment if bitten by stray dog										
Yes	393	95.9	149	97.4	146	94.8	98	95.1	1.60[a]	0.780
No	7	1.7	2	1.31	3	1.9	2	1.9		
Don't know	10	2.4	2	1.31	5	3.2	3	2.9		
Will report to hospital for treatment if bitten by own dog										
Yes	387	94.6	147	96.7	148	96.1	92	89.3	13.53[a]	**0.003**
No	16	3.9	5	3.3	6	3.9	5	4.9		
Don't know	6	1.5	0	0.0	0	0.0	6	5.8		
Will report to hospital for treatment if bitten by vaccinated dog										

Yes	338	82.4	127	83.0	130	84.4	81	78.6	3.71	0.451
No	62	15.1	24	15.7	21	13.6	17	16.5		
Don't know	10	2.4	2	1.3	3	1.9	5	4.9		
Will report to hospital for treatment if bitten by wild animals										
Yes	389	94.9	146	95.4	145	94.2	98	95.1	0.856	0.973
No	13	3.2	5	3.2	5	3.2	3	2,9		
Don't know	8	1.9	2	1.3	4	2.6	2	1.9		
Believe it is good to vaccinate their dogs										
Yes	403	98.5	150	98.0	153	99.4	100	97.1	6.64 [a]	**0.040**
No	2	0.5	2	1.3	0	0.0	0	0		
Don't know	4	1.0	1	0.7	1	0.6	3	2.9		
Believe Rabies can be controlled by vaccination of dogs										
Yes	362	89.4	133	88.7	138	90.8	91	88.3	7.24 [a]	0.861
No	13	3.2	6	4.0	3	2.0	4	3.9		
Don't know	30	7.4	11	7.3	11	7.2	8	7.8		
Believe that Rabies is fatal										
Yes	345	84.4	130	85.0	129	84.3	86	83.5	4.35	0.365
No	20	4.9	9	5.9	9	5.9	2	1.9		
Don't know	44	10.8	14	9.2	15	9.8	15	14.6		
Vaccination cost is affordable										
Yes	177	43.4	77	50.3	71	46.1	29	28.7	13.23	**0.010**
No	104	25.5	37	24.2	34	22.1	33	32.7		
Don't know	127	31.1	39	25.5	49	31.8	39	38.6		
Vaccination Fee is reasonable										
Yes	358	88.4	127	84.7	137	90.1	94	91.3	4.41 [a]	0.356
No	36	8.9	18	12.0	10	6.6	8	7.8		
Don't know	11	2.7	5	3.3	5	3.3	1	1.0		
Dogs should be allowed to roam freely in community										
Yes	76	18.8	25	16.7	22	14.5	29	28.2	12.68 [a]	**0.007**
No	323	79.8	122	81.3	130	85.5	71	68.9		
Don't know	6	1.5	3	2.0	0	0.0	3	2.9		
Stray dogs are problem in community										
Yes	274	67.0	110	72.4	96	62.3	68	66.0	5.31	0.257
No	100	24.4	28	18.4	44	28.6	28	27.2		
Don't know	35	8.6	14	9.2	14	9.1	7	6.8		
Controlling dog population in your area is important										
Yes	314	76.8	126	82.4	118	76.6	70	68.6	12.98	**0.011**
No	64	15.6	23	15.0	19	12.3	22	21.6		
Don't know	31	7.6	4	2.6	17	11.0	10	9.8		
Rabies can be treated after onset of clinical signs in man										

Yes	194	47.3	74	48.4	75	48.7	45	43.7	3.17	0.530
No	89	21.7	35	22.9	35	22.7	19	18.4		
Don't know	127	31	44	28.8	44	28.6	39	37.9		
Heard of World Rabies Day										
Yes	191	46.6	79	51.6	69	44.2	43	41.7	3.94	0.414
No	190	46.3	64	41.8	78	50.0	50	48.5		
Don't know	29	7.1	10	6.5	9	5.8	10	9.7		
Want authorities to euthanise stray dogs										
Yes	248	60.6	91	59.5	98	64.1	59	57.3	2.45	0.654
No	125	30.6	50	32.7	40	26.1	35	34.0		
Don't know	36	8.8	12	7.8	15	9.8	9	8.7		
Would allow own dog to be euthanised if found rabid										
Yes	301	73.4	118	77.1	110	71.4	73	70.9	4.47	0.342
No	95	23.2	33	21.6	36	23.4	26	25.2		
Don't know	14	3.4	2	1.3	8	5.2	4	3.9		
Would report if suspected outbreak of rabies is in community										
Yes	382	93.2	145	94.8	140	90.9	97	94.2	2.51	0.656
No	20	4.9	5	3.3	10	6.5	5	4.9		
Don't know	8	2.0	3	2.0	4	2.6	1	1.0		
VSD organises rabies vaccination in community										
Yes	152	37.1	61	39.9	59	38.3	32	31.1	4.52	0.340
No	197	48	75	49.0	71	46.1	51	49.5		
Don't know	61	14.9	17	11.1	24	15.6	20	19.4		
Believe authorities are doing good job in controlling dog rabies in your area										
Yes	152	37.1	57	37.3	59	38.3	36	35.0	0.86	0.931
No	204	49.8	78	51.0	73	47.4	53	51.5		
Don't know	54	13.2	18	11.8	22	14.3	14	13.6		
Willing to support rabies control campaign by vaccinating dogs										
Yes	397	97.1	149	97.4	149	97.4	99	96.1	1.50[a]	0.934
No	7	1.7	3	2.0	2	1.3	2	1.9		
Don't know	5	1.2	1	0.7	2	1.3	2	1.9		
Believe rabies in dogs is a problem in community										
Yes	220	53.7	88	57.5	75	48.7	57	55.3	3.35	0.500
No	118	28.8	42	27.5	50	32.5	26	25.2		
Don't know	72	17.6	23	15.0	29	18.8	20	19.4		
Information/education about rabies in Ghana is adequate										
Yes	110	26.8	42	27.5	38	24.7	30	29.1	1.36	0.853
No	268	65.4	99	64.7	102	66.2	67	65.0		
Don't know	32	7.8	12	7.8	14	9.1	6	5.8		

Notes: [a]:Fisher Test value; All others are Pearson Chi Square values; Boldened p-value: Significant ($p<0.05$); STMA: Sekondi Takoradi Metropolitan Area;EKMA: Effia Kuma Municipal Area.

Table 5: Cross tabulations.

Cross tabulations	χ^2 value	p-value
Have you vaccinated your dog against rabies? vrs	223	**≤0.001**
Do you have the vaccination booklet?		
Do you believe that rabies can be treated by traditional healing? vrs	61.86	**≤0.001**
Are there any locally available methods of treatment for dog bite and rabies?		
Is there a problem of stray dogs in your community? vrs	6.58	**0.010**
Do you believe it is important to control dog population in your area?		
Is the cost for vaccinating a dog against rabies affordable? vrs	6.27	**0.010**
Is the Fee for vaccination reasonable?		

On control of rabies, a high proportion (79.8%) said dogs should not be allowed to roam freely in communities, while 67% identified stray dogs as a problem in their community (Table 4). About 77% said that controlling dog population was important. As high as 60.6% of the respondents supported authorities euthanizing stray dogs. In Abuja, Nigeria, 75% of respondents were willing to support euthanasia of stray dogs [36]. Among the traditional rabies control measures in dogs are mass vaccination, movement restriction and control of stray dogs [29]. These when effective could lead to elimination of dog and human rabies. In Ghana these measures are either poorly instituted, poorly effective or non-existent. Well-coordinated efforts at public education, mass vaccination of dogs and strategic deployment of post-exposure prophylaxis should lead to early elimination of rabies [13]. The best option for rabies prevention in low and middle income countries, such as Ghana, are mass dog vaccination and an integrated approach to risk assessment during case management [48,58].

The role of the Veterinary Services Directorate (VSD) in rabies vaccination was not well known. Almost half (48%) of respondents said the VSD did not organise any campaigns. This was supported by the finding that about half of the respondents (49.8%) did not believe that authorities (presumably VSD) were doing a good job in controlling dog rabies in their area. An overwhelming majority (97.1%) were willing to support rabies control by vaccinating their animals. About 54% of the respondents thought rabies in dogs was a problem in the community. An overwhelming majority (93.2%) would report if there was a suspected outbreak of rabies in the community. These should be harnessed to help to control rabies in Ghana.

Conclusion

The main factors contributing to increase in cases of human rabies are endemic dog rabies, large numbers of unvaccinated and poorly cared-for dogs and a low percentage of people who seek medical care after being bitten by animals (Goonaratna, 1997). These should be addressed in the study area to control the incidence of rabies. Our study has highlighted pertinent findings on knowledge, attitudes, practices and perceptions on rabies which could help in the design and implementation of programmes to control and prevent rabies in the Western Region of Ghana.

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