

The Level of Coverage of Dog Vaccination Against Rabies in Moiben Sub-County, Uasin Gishu County, Kenya

Philip Kipchoge Tuwei

Senior Veterinary Officer

Department of Veterinary Services, Bungoma County, Kenya

Stephen Mwaura Kariuki

Medical School, Department of Medical Laboratory Sciences, Mount Kenya University, Eldoret, Kenya.

ITROMID, Jomo Kenyatta University of Agriculture and Technology (J.K.U.A.T) Nairobi, Kenya

Doi: 10.19044/esj.2017.v13n36p239 [URL:http://dx.doi.org/10.19044/esj.2017.v13n36p239](http://dx.doi.org/10.19044/esj.2017.v13n36p239)

Abstract

Background: Dog bites and subsequent transmission of rabies virus continue to be a public health threat in some parts of the world. While prophylaxis has proven successful in limiting transmission of rabies virus, dog vaccination coverage has been far below the WHO-recommended level of 75% in many parts, particularly in Africa and Asia. **Aim:** The aim of this study was to determine the level of dog vaccination coverage in Moiben Sub-county of Uasin Gishu County, Kenya. The study also sought to investigate the reasons for possible low dog vaccination coverage. **Methodology:** The dog owners were interviewed using structured questionnaires on whether they had their dogs vaccinated, the frequency of vaccination and the number of dogs maintained per household. The respondents were also interviewed on whether their dogs were confined or not and whether they had bitten residents or not. Data was entered into SPSS version 22 of 2013 for analysis. The data was analyzed using chi square and the statistical significance determined at critical p-value of 0.05 and 0.01 in some cases. **Results:** The coverage of dog vaccination against rabies virus in Moiben Sub-county, Uasin Gishu County was found to be 19.5% (130/666). The number of dogs that had not been vaccinated were 536 out of 666 accounting for 80.5% of the sample in this study. It was established that 32.7% of dogs kept in singles per household and 5.9% of dogs kept in more than 4 dogs per household were vaccinated. The findings show that number of dogs kept by each household is significantly associated ($X^2=32.2$) with the level of vaccination coverage. We also found that a total of 351 (54.6) children below 15 years

were the majority who had been bitten by dogs ($X^2 = 26.3$, $p = 0.01$) while the least bitten were those above 46 years of age. It was also established that the unconfined dogs (487/75.7%) significantly bit more people than those that were partially confined ($X^2 = 12.9$, $p = 0.01$)

Conclusion and Recommendation: The dog vaccination coverage at 19.5% in Moiben Sub-county is far below the 75% level recommended by the WHO. The frequency of dog vaccination was found to be once a year among some dog owners, twice among a few others, and once in the life-time of the dog among some dog owners. There was an inverse proportionality between vaccination frequency and the number of dogs owned per household. Dog confinement limits dog bites and hence should be enforced among dog owners. This study recommends that households in Moiben Sub-county keep the number of dogs that they can manage with regards to vaccination to be able to control rabies virus transmission. The county government of Uasin Gishu should move with speed to make and implement a policy on dog ownership to regulate the number of dogs owned per household.

Keywords: Dog vaccination coverage, coverage of dog vaccination, Moiben Sub-county, Human rabies, rabies virus

Introduction

Rabies is a fatal infectious zoonotic disease that is transmitted to humans by interacting with canines that harbour the rabies virus (Cleaveland, et al., 2006). The virus is bullet shaped enveloped RNA virus belonging to genus *lyssavirus* of family *Rhabdoviridae*, order *Mononegavirale* (Kaindi, 2008). Currently, this genus comprises 7 genotypes, type 1 of which represents the classic human rabies virus. Four new putative genotypes await definitive classification. These viruses are enveloped and have a single stranded RNA genome with negative-sense. The genetic information is packaged as a ribonucleoprotein complex in which RNA is tightly bound by the viral nucleoprotein. The RNA genome of this virus encodes 5 proteins (genes), whose order is highly conserved across genotypes: nucleoprotein (N), phosphoprotein (P), matrix protein (M), glycoprotein (G) and the viral RNA polymerase (L) (Finke and conzelmann, 2005). The G glycoprotein carries the main antigenic sites (WHO, 2008). Rabies virus has been isolated from nearly all mammals (Darryn et al., 2007).

Globally 55,000 people die from rabies annually and about 3.5 million people receive post-exposure treatment (WHO, 2008). By 1986, eighty-seven countries with a combined population of 2.4 billion had experienced canine rabies, which is the major cause of human rabies (Borus, 1996; Salome, et al., 2008).

In efforts to curtail the widespread of infection with rabies virus, the deployment of an egg-adapted modified live virus vaccine in the 1950, and 1960s effectively controlled human rabies so that by 1973, the disease was virtually eliminated from Kenya. Following an outbreak of the disease in late 1974 in the then Taveta Division of Taita/Taveta District, the rabies situation changed dramatically in the country since then (Kitala, 2008).

Experimental vaccination of wildlife with vaccinia-rabies glycoprotein (V-RG) vaccine (live) in bait for foxes in Europe and North America has yielded promising results (Cynthia, 2005). This recombinant virus vaccine has been successfully used in Belgium, France, Germany, and the United States to prevent outbreak of rabies in wildlife (Reece & Chawla, 2006). The prevention of the disease after the bite by an infected animal has increasingly been successful since the introduction of effective vaccines. The vaccines contain inactivated or killed virus produced from suspension of infected rabbit brain. These vaccines are cheaper and are still used widely in developing countries. It is however, important to note that variable potency and inadequately inactivated vaccines have themselves caused human rabies (Linda, 2005). Duck embryo vaccine produced very little neurotoxicity but caused local reaction and is poorly immunogenic. The latest vaccines are prepared in human diploid cell in tissue culture and carry virtually no risk of reaction. They also stimulate quite strong antibody response. Overall use of post exposure vaccines simultaneously with rabies immunoglobulin within 48 hours of the bite reduces the risk of developing the disease by rabies from 15% to 1% (CDC, 2004).

In many parts of Asia and Africa, the vaccination coverage established in the dog population (30% to 50%) is not high enough to break the transmission cycle of the disease (WHO, 2005). Effective vaccination campaigns need to reach a sufficient percentage of the population to eliminate disease and prevent future outbreaks, which for rabies is predicted to be 70%, at a cost that is economically and logistically sustainable. Domestic dog rabies has been increasing across most of sub-Saharan Africa indicating that dog vaccination programmes to date have been inadequate (Kaare et al, 2009).

The aim of the current study was to determine vaccination coverage of the dogs against rabies in Moiben Sub-county, Uasin Gishu County in Kenya.

Methodology

This work was planned as a cross sectional study whose aim was to establish the level of coverage of anti-rabies vaccination in the dog population in Moiben Sub-county. A sum of 339 respondents was chosen from a total of 1152 households for interviews on whether their dogs had

been vaccinated or not. The respondents were further interviewed on whether their dogs were confined or not, and whether they had bitten residents or not. The sample to be interviewed was drawn utilizing multistage sampling, simple random sampling and systematic sampling methods. The head of the household or an agent who acts when the head is absent was picked to fill-in the questionnaire for the survey. The exclusion criteria were strictly followed so that those below 20 years or those over 80 years did not participate in the interviews. This was done to ensure that the data collected was as accurate as possible.

All data from the study was entered into SPSS version 22 of 2013 for cleaning and analysis. The findings were then summarized as frequencies, cross tabulations as well as percentages for presentation. To determine any statistical significance of the findings, chi-square test (X^2) was employed and any significance reported at critical p-value of 0.05 and 95% confidence limit.

Results

Dogs population and Ownership

From the study findings there was a total of 666 dogs in the 339 households studied in Moiben Sub-county. The ratio of the dog to human population was 1:3 (666 dogs to 2034 humans) (table 1.1). The respondents that were interviewed kept varied number of dogs in their households; 31.6% of the respondents kept 1 dog, 48.7 % kept 2 dogs, 13.9% kept 3 dogs, 3.5% kept 4 dogs and 2.3% kept 5 dogs. Therefore, the majority of households (48.7%) kept two dogs – there was an average of 2 dogs per household (666/339).

Table 1.1: Dog Ownership in Moiben Sub-county

Percentage of Dog Owners	31.6	48.7	13.9	3.5	2.3
Number of Dogs kept	1	2	3	4	5

Dog Bites and Dog Confinement

When respondents were asked whether their dogs bit people or not in the last one year that presided this study, the statistics were as in table 1.2 below. Of the 2034 individuals who lived in the 339 household surveyed in this study, 351 (54.6) children below 15 years were the majority who had been bitten by dogs ($X^2 = 26.3$, $p = 0.01$) while the least bitten were those above 46 years of age. This study found that 487 dog bites (75.7%) were from dogs not confined while 156 dog bites (24.3%) were by dogs confined during the day and left free at night. This shows that unconfined dogs

significantly bit more people than those that were partially confined ($X^2 = 12.9, p = 0.01$)

Table 1.2: Dog Bites Among Residents of Moiben Sub-county

Factors Influencing Dog Bites	Bitten Individuals			Statistical Test of Significance
	Yes	No	Total	
<15 years	351 (54.6%)	601	952	$X^2 = 26.3$ $p = 0.01$
16-30 years	117 (18.2%)	312	429	
31-45 years	97 (15.1%)	304	401	
>46 years	78 (12.1%)	174	252	
Total	643	1391	2034	
Partially confined Dogs	156(24.3%)	1391	2034	$X^2 = 12.9$ $p = 0.01$
Unconfined Dogs	487(75.7%)			
Total	643			

Dog Vaccination Coverage Against Human Rabies

The majority of dogs in Moiben Sub-county had not been vaccinated (536/666, 80.5 %,) as at the time of this study. The vaccinated dogs accounted for only 19.5 % (130/666). It was established that 32.7% of dogs kept in singles per household and 5.9% of dogs kept in more than 4 per household were vaccinated. This implies that the fewer dogs are kept, the easier to vaccinate them effectively.

The current research findings indicate that the number of dogs vaccinated was inversely proportional to the number of dogs kept by the respondents' households, that is, the higher the number of dogs the lower the vaccination coverage for any given household (Figure 1.0). Taking the number of dogs as the independent variable and vaccination as the dependent variable and conducting scatter plot the derived regression equation is as follows:

$$\text{Percentage of vaccinated dogs} = 42.64 - 8.32 * \text{No. of dogs}$$

The intercept is 42.64 and the slope is -8.32. This negative implies inverse proportionality. The findings show that number of dogs kept by each household was significantly associated ($X^2 = 32.2$) with the level of vaccination coverage. Vaccinated dogs were identified from vaccine certificates held by their owners. Sixty percent were vaccinated during government vaccination campaigns while the rest were vaccinated by private veterinarians upon request by the dog owners.

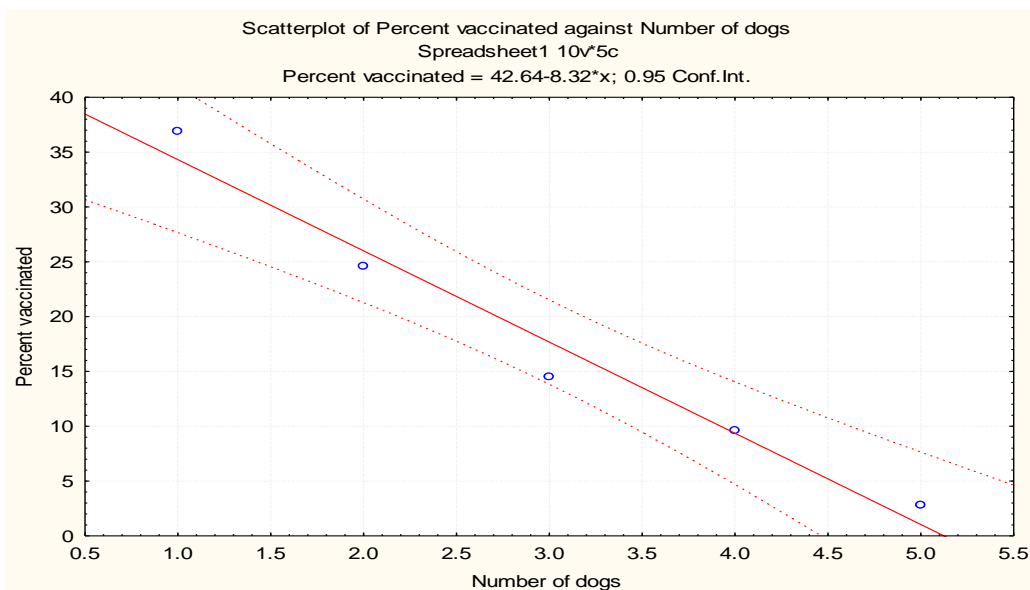


Figure 1.0: A scatter plot of % of dogs vaccinated in Moiben Sub-county and the number of dogs per household.

Discussion

Dog vaccination coverage against rabies

Despite majority of household individuals owning dogs in Moiben Sub-county, only a few individuals ensured that their dogs were vaccinated adequately. It was established from the study that only 19.5% (130/666) of the total dog population were vaccinated as at the time of this study. Dog vaccination coverage in Kenya was estimated to be less than 10% (Karugu, 2008). The principal factor that might be contributing to the low prioritization of human rabies control was due to lack of information about the burden and impact of the disease caused by this canine-transmitted virus (WHO, 2001; Awahndukum et al., 2002). The WHO reported that in many parts of Africa and Asia, vaccination established in the dog population was between 30-50% which is not high enough to break the transmission cycle rabies (WHO, 2005). Vaccination coverage of more than 70% (critical percentage) is envisaged to eliminate the disease and prevent future outbreak (Kaare, 2009; Guy., et al 2009). The World Health Organization has set the coverage target level at 75% for dog vaccination (WHO, 2005) while in Thailand vaccination coverage in dog population was set at 80% target levels (Denduangboripant, et al., 2005). A vigorous mass vaccination campaign was done covering 3,300 dogs (87%) in Nyeri County, Kenya. Before then, dog vaccination coverage in the same County was 15% (Karugu, 2008). This shows that vigorous vaccination campaigns drastically reverses the perception that dog vaccination target level (75%) set by WHO is not

achievable. The current research show that vaccination coverage (19.5%) in Moiben Sub-county was far below this mark of 75% (WHO, 2005). However, the dog vaccination coverage was higher than what was documented (9.6%) by the divisional veterinary department, in the defunct Moiben Division (Now Moiben Sub-county) (Vet Dept, 2006). Hampson, et al., (2008), in their study concluded that, data from African countries clearly show limited efforts have ensured only 60% vaccination coverage levels, and that is why human rabies remains a persistent problem. Some researchers noted that majority of dog owners rarely immunize their dogs against dangerous infectious human rabies disease (Yator, 2012).

In the present study, it was observed that majority of people of Moiben Sub-county, vaccinated their dogs mainly during regular government vaccination campaigns, which they found cheaper compared with private vaccinations. A few opted for private vaccinations when the dog had bitten somebody or it was very aggressive and likely to bite. For dog owners who vaccinated their dogs, the frequency of vaccination varied; majority had no specific time of vaccinations, some did it once a year, very few did twice a year and others vaccinated their dogs once in the lifetime of the dog. The recommended vaccination frequency should be once every 3 years after an initial series of 2 vaccinations 1 year apart. Rabies virus vaccines can safely be administered to pups <3 months of age (Barrat, et al. 2001). Young pups usually make up a large proportion (>30%) of African dog populations (Knobel, et al., 2007), yet there is a widespread perception among veterinary authorities and dog owners that they should not be vaccinated, which leads to insufficient vaccination coverage (Kaare, et al. 2009) hence an increase in the risk to transmit rabies virus.

In our current study, it was established that there was an association between dog vaccination coverage with the number of dogs kept per household ($X^2=32.2$). Respondents keeping more than two dogs hardly vaccinated them as compared to those keeping one or two dogs per household. In Thailand, the average dog-ownership was 0.9 dogs per household (Kongkaew, 2004). This means that some few households did not even own one dog. A similar report was made by Karugu (2008). The WHO has reported that, vaccination coverage in large populations was very low because of the high cost involved and the difficulty of catching the unconfined dogs for vaccination. Suzuki et al (2006,) recommended that, for effective and successful rabies control, dog ownership and restriction of dog movement as well as vaccination of young dogs should be emphasized. Prophylaxis in canines particularly the dogs has proven nearly 100% successful in limiting infection with human rabies virus (Linda, 2005).

Dog Confinement and Dog Bites

Dog confinement appears to limit the number of dog bites, as indicated by the 487 dogs (75.7%) were not confined and bit people compared to 156 dogs (24.3%) partially confined dogs that bit people in the same period. This was expected because when dogs are not confined they will tend to bit particularly strangers and those that provoke them. This findings are consistent with those by Omemo (2012) in his study of dog bites in Kisumu County, Kenya, where he found that unconfined and stray dogs accounted for the majority of dog bites. We believe that the reason for majority of those bitten being children below 15 years is because children normally like playing around with dogs regardless of whether it is strange or their own dogs, and whether confined or not. Though it was not within the scope of the current study to determine whether those dogs that bit people were vaccinated or not, and whether they transmitted rabies virus or not, we believe there is high likelihood of transmission given the low coverage (19.5%) of dog vaccination in Moiben Sub-county.

Conclusion and Recommendation

Coverage of dog vaccination in Moiben Sub-county was very low (19.5%) compared with 75% recommended by WHO that will eliminate and prevent future human rabies outbreak. Vaccinations of dog against rabies were done mainly during government vaccination campaign. The researchers in this study therefore, recommend that the community should be advised to keep manageable number of dogs that can be easily restrained or confined, and vaccinated on regular basis as recommended by the WHO. Dogs should be confined as the unconfined ones account for highest prevalence of dog bites possibly leading to transmission of rabies virus. The department of Public Health and Sanitation of the ministry of health and that of Livestock Development need to work together with the county government of Uasin Gishu in the prevention and control of human rabies. The county government of Uasin Gishu should move with speed to make and implement a law on dog ownership to regulate the number of dogs owned per household if control of human rabies will ever be successful.

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