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RESEARCH ARTICLE

DO AWARENESS CAMPAIGNS IMPROVE COMMUNITIES' KNOWLEDGE, ATTITUDES, AND PRACTICES ON RABIES? A TWO-STAGE STUDIES IN MENABE REGION, MADAGASCAR

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Abstract

In November 2020, a Baseline study was conducted among 342 participants, followed by an awareness campaign. Then an Endline study was carried out with 337 other participants in January 2021, to assess communities' knowledge, attitudes, and practices (KAP) related to rabies in the same study areas. The same questionnaires were used to assess communities KAP. A significant improvement in participants' KAP related to rabies was observed. The good knowledge average score increased from 36% to 61%, positive attitudes improved from 39% to 55%, and good practices increased from 7% to 81%. The participants mean KAP score increases from 27% at Baseline to 66% at Endline. Multivariable logistic regressions performed after both phases revealed that participants who heard or saw information about rabies during an awareness campaign had higher KAP levels compared to others. This study demonstrated the awareness campaign importance, and the need to continue and intensify efforts to raise rural communities' awareness, by using mass communication methods such as radio broadcasts, video spots and flyers in local language to reach more people.

Introduction:-

Rabies, a zoonotic disease caused by Lyssavirus, is a significant public health concern, leading annually to 50,000 to 100,000 deaths annually (Singh et al., 2017). The disease is transmitted through the bite of rabid animals and 95% of human deaths occur in Africa and Asia, particularly in rural communities of developing countries (Hampson et al., 20215; Okonko, 2010; Schnell McGettigan et al., 2010; WHO, 2012). Rabies is a fatal disease, but it can be prevented through vaccination in both animals and humans (Chernet, 2016; Fooks et al., 2014), and in the event of a bite, particularly in the case of a deep bleeding bite wound, post-exposure prophylaxis (PEP) is required, even if the biting animal is vaccinated (Dumas et al., 2016). Awareness campaigns are also important in rabies prevention because they may significantly improve knowledge of rabies symptoms and vaccination schedules, leading to increased pet vaccination rates (Hasanov et al., 2017).

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Rabies prevention requires appropriate knowledge of all its reservoirs, vectors, and contamination modes, as well as positive attitudes and recommended practices following an animal bite incident. However, most health care management is heavily concentrated in urban areas, leaving rural communities at a disadvantage. This is further exacerbated by the unavailability and access to appropriate health care services in rural areas. The geographical inaccessibility of health facilities including PEP, and low awareness about rabies are significant factors contributing to this disparity. In this context, the rural communities Knowledge-Attitudes-Practices (KAP) assessment is an important aspect of rabies control. In fact, the wildlife role in rabies transmission is often overlooked, particularly in developing countries (Aiyedun et al., 2017).

Rabies has been circulating in Madagascar since at least the 19th century with a high prevalence in domestic animals, particularly dogs (Morvan et al., 1993; Reynes et al., 2011), and it remains an ongoing issue, with a high incidence of human deaths and a widespread presence of the virus in domestic animals. The provision of post-exposure prophylaxis (PEP) has been effective in reducing the burden of rabies, but access to PEP is limited to only a few health care facilities in the country (Rajeev, 2018). In order to develop diagnostic and surveillance methodologies across Madagascar 31 Antirabies Treatment Center (ATC), the Pasteur Institute of Madagascar and the Malagasy Ministry of Public Health have collaborated for years.

However, due to many rabies cases being under-reported, a lack of awareness and knowledge about PEP, the available data underestimate its importance, and these are significant issues in many countries, where the disease is prevalent (Meng et al., 2011; Rajeev et al., 2018). Nevertheless, since the 1990s, the number of suspected cases of human rabies reported by health care facilities has been increasing. More than 80% of animals' rabies cases involve dogs, the primary vector (Nobel et al., 2005). Eliminating rabies in dogs is hindered by factors such as the increasing number of stray dogs, insufficient awareness, strong control policies, and low dog vaccination rates. So, reducing the burden of rabies in both animals and humans requires controlling the disease at its source. That requires many actions like mass vaccination campaigns for dogs, effective management and control strategies, veterinary education, interdisciplinary collaboration, etc. (Cripps et al. 2000; Kassié et al., 2023).

According to the consultation forms from the Antirabies Treatment Center (ATC) at the Pasteur Institute of Madagascar, the Menabe region, which hosts natural reserves and an ACT, a total of 528 consultations (268 in 2017 and 260 in 2018) were recorded for rabies exposure. Among these, 82.4% (435 consultations) were due to dogs, 4.9% (26 consultations) to cats, and 2% (11 consultations) to lemurs, bushbabies and others (unspecified). Children under 15 years old were the most exposed (28.6% or 151/528 of consultations). Few data are available on the Knowledge-Attitudes-Practices of communities in this region (Randriafaraniaina, 2022).

This study's main objective was to evaluate the awareness campaign importance about rabies control and prevention, including knowledge, attitudes, and practices, using tools designed for a local context. The specific objectives were: i) to assess the knowledge, attitudes, and practices (KAP) of communities living in the neighboring Fokontany of the Menabeproected area regarding rabies, ii) to lead raising awareness about rabies by using the potential most suitable tools, iii) to evaluate the knowledge, attitudes, and practices (KAP) in the same studied areas.

Materials and Methods:-

Study area

In Madagascar, administrative divisions include Districts, which cover a larger geographical area compared to Communes and Fokontany. This study focused on participants from ten Fokontany located within natural reserves (protected areas) in the Menabe region of western Madagascar. These natural areas are tourist sites that are regularly visited by many tourists. This choice is important because rabies virus the circulation has been confirmed in both animals (domestics and wilds) and humans' interface across the island (Reynes et al., 2011). These Fokontany are located at approximately 650 km from the capital Antananarivo, and are between 6 km (Bemanonga) and 95 km (Tsimafana) from Morondava (Figure 1).

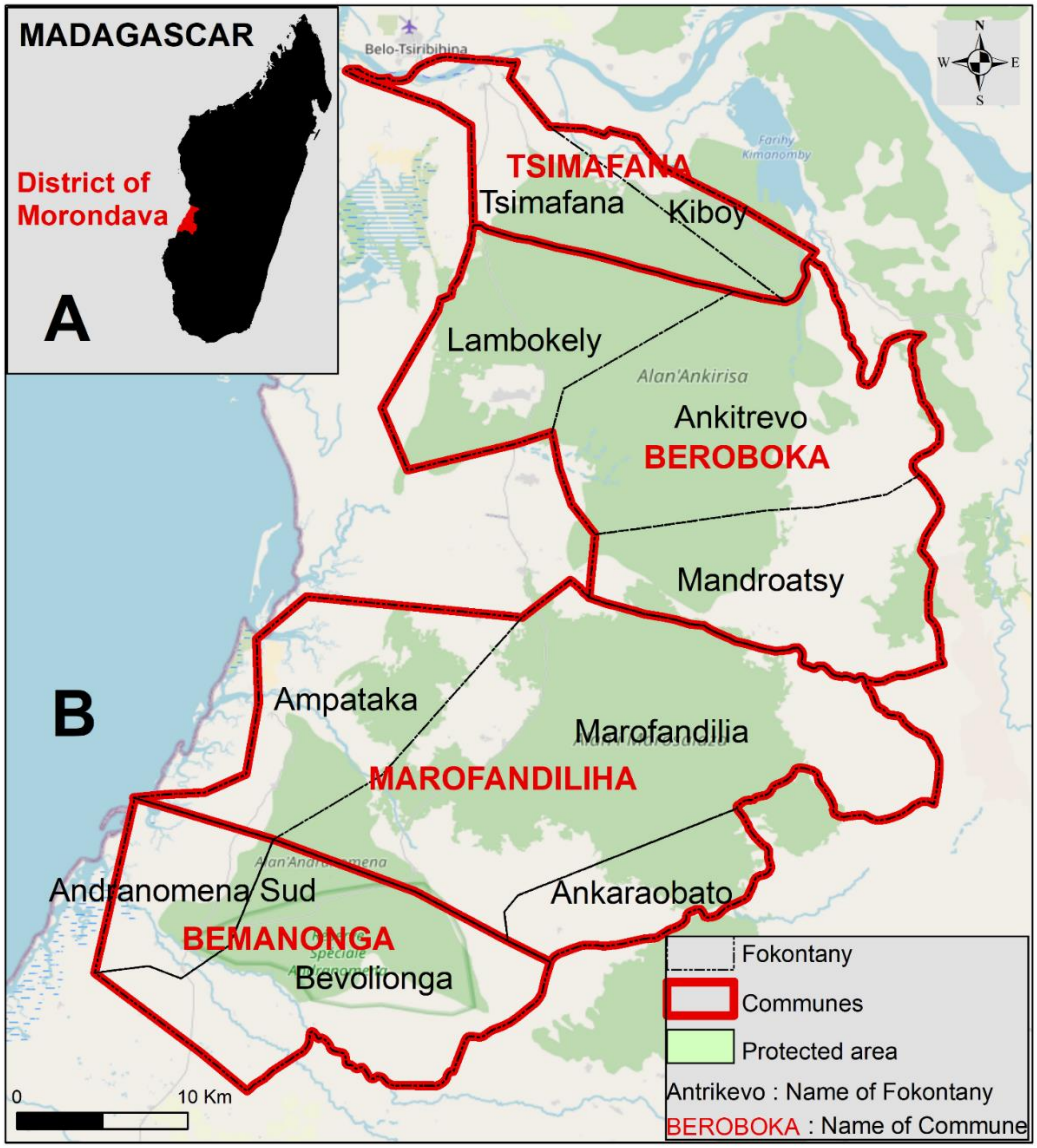

Figure 1:- Maps of Morondava District in Madagascar and study areas (A). Red: Communes limits; Black studied fokontany limits (B).

Study Methodology:-

A descriptive cross-sectional community study was conducted in ten Fokontany, carried out in two phases (Baseline and Endline). For both phases, questionnaires were administered to random selected heads of households or their representatives. The same number of participants was expected in each Fokontany for both phases. Data were collected on sociodemographic characteristics, dog ownership, and information on the communities' knowledge, attitudes, and practices regarding rabies, using questionnaires surveys. The questionnaires were available in both French and Malagasy language, through KoboCollect on smartphones, and the data were collected face-to-face.

The Baseline took place from November 5 to 29, 2020. Following this phase, awareness messages on rabies were broadcast through two local radio stations, a video spot designed for this study, and described elsewhere by Kassié et al. (2023) was displayed in each Fokontany, then distributed via Bluetooth, USB keys, and compact discs and to people who wanted to keep it. Flyers were distributed to people, including the non-surveyed. Posters were dispatched in each Fokontany in attractive places like markets and Fokontany's main office. The Endline study took place from January 5 to 22, 2021.The same baseline questionnaire was used and administered to a randomly selected heads of households or their representatives.

For each participant, Knowledge, Attitude, and Practices (KAP) score was calculated from 25 questions. This score was calculated by attributing one point to each correct answer, and zero point for incorrect or unknown answers. These points were summed to determine Knowledge score, Attitude score, and Practice score. An individual KAP score, then a proportion of correct answers were calculated for each participant.

For the entire study population, the overall KAP score was determined in each phase by summing these three KAP scores. The overall KAP score was split into two levels based on its mean: Participants whose individual KAP score was at least equal to the overall KAP mean were characterized as having "Good KAP", and the others as having "Poor KAP".

Study population

The questionnaires were administered to household heads or their representatives over 18 years old, who consented to participate. The sample size was determined using Cochran's sample size formula (Giezendanner, 2012).

$n = \frac{t^2 p(1-p)}{e^2}$

n: Expected sample size;

t : Z-score corresponding to the desired confidence level (e.g., for a 95% confidence level, Z might be approximately 1.96);

p: Estimated proportion of the population with the characteristic being studied in the survey. We considered p to be 32.3%, which is the estimated proportion of rural populations in the Moramanga District (Madagascar) with a goodq level of knowledge on rabies control and prevention practices (Leblanc, 2019).

e: Desired margin of error has been set at 5%;

By applying the formula: $n = \frac{(1.96)2\times 0.32(1-0.32)}{(0.05)2}$

The calculated sample size is 335 adults (household heads or respondents).

Sampling Method:-

Stratified random sampling technique was chosen in this survey. The sampling frame was based on the number of people given by the Fokontany offices. For each Fokontany, the number of households to be surveyed was estimated by using the total population and the average number of individuals per household (4.3 individuals per household). The number of households to survey by Fokontany was proportional to the size of the Fokontany (Table 1). The households to survey were randomly selected, based on an adult willingness to participate in the study. In each household, only one adult (the household head or his/her respondent) was surveyed. If there was no adult at home or he refused, another household was randomly selected.

Table 1:- Number of households to survey by Fokontany.

Fokontany	Total population N=8 289	Estimated number of households (N=1 928)	Proportion of households to survey (%) (N=100)	Number of households to survey (n=335)
Ampataka	1089	253	13	44
Andranomena	767	178	9	31
Ankoraobato	1006	234	12	41
Bevolonga	547	127	7	22
Marofandiliha	858	200	10	35
Lambokely	675	157	8	27
Mandroatsy	334	78	4	13
Anketrevo	187	43	2	8
Tsimafana	1877	437	23	76
Kiboy	949	221	11	38

Tools for communities' awareness campaign

There are several tools for mass communication activities. However, for this study, the tools used were printed media (posters and flyers), radio, and a short video spot, all in Malagasy language. The posters were placed in attractive areas including markets and the Fokontany offices. The flyers were distributed to people in the same attractive places, including non-participants in the study. Awareness campaigns by a video spot on rabies were

scheduled, and people were invited to attend it. The same content was broadcast on local radio stations covering the studied Fokontany.

Data management and analysis

The data collected through questionnaires were centralized on the KoboToolbox platform. R software was used for data management and analysis. Descriptive statistics, then Chi-square tests were performed to seek the association between the dependent variable (KAP levels on rabies) and explanatory variables (dog ownership, sociodemographic characteristics, etc.). Multivariable logistic regression models were performed to determine the factors influencing the KAP levels on rabies. The non-parametric Wilcoxon test was used to compare the means of each Fokontany at Baseline and Endline.

Results:-

Participants sociodemographic characteristics during both phases

At least 335 households were estimated to be surveyed for each phase. Finally, 342 households were selected during the Baseline and 337 households during the Endline. During the Baseline, 145/342 (42.3%) respondents (participants) were women, whereas, during the Endline, 207/337 (61.42%) respondents were women. The mean age of the respondents was 42 years. In the Baseline, 157/342 (45.9%) respondents were aged 41 to 60, while during the Endline, the mean age was 41 years and 176/337 (52.2%) respondents were aged 18 to 40.

Most of the participants during the Baseline, 214 (62.6%) had received formal schooling, while during the Endline, 207 (61.4%) respondents were non-schooled. The main ethnic group from the study area was the Sakalava. They were 132 respondents (38.6%) during the Baseline and 132 respondents (39.2%) during the Endline. Dogs were owned by 16.7% of the respondents (342) during the Baseline, and by 8.3% of the respondents (337) during the Endline.

Knowledge, attitudes, and practices description during both phases

Most of the participants had already heard about rabies, 269 respondents (78.7%) at Baseline and 325 (96.4%) at Endline. Regarding the knowledge, the means for all participants at Baseline were 0.36 (36% of good knowledge) and at Endline 0.61 (61% of good knowledge). The means of attitudes towards rabies were 0.39 (39% positive attitudes) at Baseline and 0.55 (55% positive attitudes) at Endline. For practices related to rabies, the means were 0.07 (7% of good practices) at Baseline and 0.81 (81% of good practices) at Endline. When taking into account together knowledge, attitudes and practices (KAP), the overall KAP means scores for participants were 0.27 (27% correct responses) at Baseline and 0.66 (66% correct responses) at Endline. The difference between the two means was statistically significant ($p<0.001$).

Bivariate analysis between KAP level and participants' characteristics at Baseline

At Baseline, some sociodemographic characteristics of the participants were closely associated with their KAP level about rabies, at a chi-square test p-value less than 0.20, in bivariate analysis. These variables were ethnicity, religion, literacy level, having heard of rabies (Table 2).

Table 2:- Bivariate analysis between KAP level and participants' characteristics at Baseline.

	Number of participants at Baseline		
Variables/modalities	**Poor KAP n(%)**	**Good KAP n(%)**	**p-value**
Age			0.257
[18-40]	78(22.8)	65(19)	
[41-60]	71(20.8)	86(25.1)	
[61-78]	22(6.4)	20(5.8)	
Gender			1
Male	98(28.7)	99(28.9)	
Female	73(21.3)	72(21,1)	
Ethnicity			**< 0.001**
Sakalava	54(15.8)	78(22.8)	
Antandroy	62(18.1)	60(17.5)	
Antesaka	39(11.4)	17(5)	
Betsileo	3(0.9)	10(2,9)	

Others	13(3.8)	6(1.8)	
Activities carried out			0.319
Several activities	137(40.1)	145(42.4)	
One activity	34(9.9)	26(7.6)	
Religion			**< 0.001**
Engaged in religious practice	94(27.5)	127(37.1)	
Non-practicing religion	77(22.5)	44(12.9)	
Literacy level			**< 0.001**
Non-schooled	84(24.6)	44(12,9)	
Schooled	87(25.4)	127(37.1)	
Having heard of rabies			**< 0.001**
Yes	102(29.8)	167(48.8)	
No	69(20.2)	4(1.2)	
Ownership of a dog			0.384
Yes	32(9.4)	25(7.3)	
No	139(40.6)	146(42.7)	
Experiencing a dog bite in the family			0.665
Yes	13(3.8)	10(2.9)	
No	158(46.2)	161(47.1)	
Having received recent information about rabies			0.246
Yes	0(0)	3(0.9)	
No	171(50)	168(49.1)	
Awareness of animal health care professional existence			1
Yes	104(30.4)	105(30.7)	
No	67(19.6)	66(19.3)	

Multivariable analysis between KAP level and participants' characteristics at Baseline

Mulvariable logistic regression model was performed by integrating variables with a chi-square test p-value less than 0.20 in previous bivariate analysis at Baseline. After this logistic regression analysis, a significant association was found between having already heard of rabies and a good KAP level (OR = 23.5, 95% CI: 9.25-79.69, p<0.001). Participants who had already heard of rabies before our survey were 23.5 times more likely to have a good KAP level than those who had never heard of this disease (Table 3).

Table 3:- Multivariable analysis between KAP level and participants' characteristics at Baseline

Variables/modalities	**p-value**	**OR [IC95%]**
Ethnicity	0,146	
Sakalava		2,29[0,72-7,62]
Antandroy		2,07[0,65-6,90]
Antesaka		1,06(0,31-3,92]
Betsileo		4,31[0,72-7,62]
Others		
Religion	0,119	
Engaged in religious practice		
Non-practicing religion		0,63[0,35-1,12]
Literacy level	0,105	
Schooled		0,90[0,8-2,90]
Non-schooled		
Having heard of rabies	**<0,001**	
Yes		**23,5[9,25-79,69]**
No		

Examining this variable closely in our study, the proportion of participants who had previously heard of rabies was 78.7% (269/342). For the very first time, their relatives were the main information source (89.2% or 240/269), while

the school represented 3.7% (10/269), and other sources, such as a doctor, a veterinarian or other people were 7.1% (9/269) of respondents.

Bivariate analysis results between KAP levels and participants' characteristics at Endline

At Endline some sociodemographic characteristics of the participants were closely associated with their KAP level about rabies, at a chi-square test p-value less than 0.20, in bivariate analysis. These variables were ethnicity, religion, literacy level, having heard of rabies, awareness of animal health care professionals' existence, having seen rabies awareness tools during the last three months (Table 4).

Table 4:- Bivariate analysis results between KAP levels and participants' characteristics at Endline

	Number of participants at Endline		
Variables/modalities	**Poor KAP n(%)**	**Good KAP n(%)**	**p-value**
Age			0.674
[18-40]	50(14.8)	126(37.4)	
[41-60]	38(11.3)	83(24.6)	
[61-78]	14(4.2)	26(7.7)	
Gender			0.488
Male	36(10.7)	94(27.9)	
Female	66(19.6)	141(41.8)	
Ethnicity			**0.12**
Sakalava	31(9.2)	101(30)	
Antandroy	39(11.6)	71(21.1)	
Antesaka	28(8.3)	50(14.8)	
Others	4(1.2)	13(3.9)	
Activities carried out			0.842
Several activities	48(14.2)	115(34.1)	
One activity	54(16)	120(35.6)	
Religion			**0.001**
Engaged in religious practice	37(11)	132(39.2)	
Non-practicing a religion	65(19.3)	103(30.6)	
Literacy level			**0.003**
Non-schooled	75(22.3)	132(39.2)	
Schooled	27(8)	103(30.6)	
Having heard of rabies			< **0.001**
Yes	90(26.7)	235(69.7)	
No	12(3.6)	0(0)	
Ownership of a dog			0.396
Yes	6(1.8)	22(6.5)	
No	96(28.5)	213(63.2)	
Experiencing a dog bite in the family			0.568
Yes	4(1.2)	5(1.5)	
No	98(29.1)	230(68.2)	
Having seen rabies awareness tools during the last three months			< **0.001**
Yes	57(16.9)	234(69.4)	
No	45(13.4)	1(0.3)	
Awareness of an animal health care professional existence			**0.159**
Yes	57(16.9)	152(45.1)	
No	45(13.4)	83(24.6)	

Multivariable analysis between KAP level and participants' characteristics at Endline

A multivariable logistic regression model was also performed by integrating variables with a chi-square test p-value less than 0.20 in previous bivariate analysis at Endline. After this logistic regression analysis, having already heard of rabies before our Endline survey and having seen rabies awareness campaign tools during the last three months before our Endline survey were statistically associated with the good KAP level of participants ($p<0.05$). In comparison to participants who have never heard of rabies, those who have heard of rabies were 6.7 times more likely to have a good KAP level (OR=6.7; 95% CI=6.3-14, $p<0.001$). Compared to respondents who have not seen any rabies awareness tools, those who have seen the tools are 21 times more likely to have a good KAP level on rabies (OR=21; 95% CI=4.3-38, $p<0.001$) (Table 5).

Examining this variable closely in our study, the proportion of participants who had previously heard of rabies was 96.4% (325/337). For the very first time, their relatives were the main information source (95.4% or 310/325), while the school represented 2.5% (8/325), and other sources, such as the veterinarian or other people were 3.4% (11/325) of participants.

Participants who saw rabies awareness campaign tools during the last three months before our Endline survey were 291 (86.3% of the 337) of respondents.

Table 5:- Multivariable analysis between KAP level and participants' characteristics at Endline.

Variables/modalities	**p-value**	**OR [IC 95%]**
Ethnicity	0,82	
Sakalava		1,0[0,6-4,4]
Antandroy		7,1[1,1-29,4]
Antesaka		1,04[0,1-4,8]
Others		1
Religion	0,55	
Engaged in religious practices		1
Non-practicing a religion		5,65[2,7-11,4]
Literacy level	0,26	
Non-schooled		1
Schooled		2,3[0,01-4,6]
Awareness of an animal health care professional existence Yes No	0,21	 1,9[0,1-3,4] 1
Having heard of rabies	**< 0,001**	
Yes		6,7[6,3-14]
No		1
Having seen rabies awareness tools during the last three months	**< 0,001**	
Yes		21[4,3-38]
No		1

Fokontany's average KAP scores evolution between Baseline and Endline

At the Fokontany scale, a means KAP means scores were calculated before (Baseline) and after the awareness-raising campaign (Endline). These scores were calculated from all participants living in each Fokontany. The overall KAP means scores for all ten Fokontany were found improved between the two phases, with correct responses increasing from 27.9% at Baseline to 66.1% at Endline. The difference between the means was statistically significant ($p<0.001$). The mean scores by Fokontany also increased after the awareness campaign (Table 6).

Table 6:- Knowledge-Attitudes-Practices average scores average at Baseline and Endline per Fokontany.

Fokontany	**KAP scores average**		
	Baseline	**Endline**	**p-value**
Ampataka	0,29	0,6	**< 0,001**
Andranomena Sud	0,29	0,68	
Ankaraobato	0,21	0,65	

Anketrevo	0,12	0,59	
Bevolonga	0,25	0,74	
Kiboy	0,27	0,67	
Lambokely	0,25	0,68	
Mandroatsy	0,24	0,59	
Marofandiliha	0,18	0,67	
Tsimafana	0,41	0,67	

Awareness tools scope within community

For this study, the awareness tools used were posters, flyers, a radio spot, and a short video spot. All these materials contained identical information about the measures to be taken in the event of a dog bite and the rabies epidemiological surveillance. The broadcast messages are divided into two parts.

The first part was about rabies transmission mode to humans, the animals willing to contract rabies, and the recommended actions following a dog bite, such as:
- Washing the wound with water and soap for at least 15 minutes and thoroughly rinsing it;
- Seeking immediate treatment at the nearest health care facility and adhering to the medical staff's instructions.

The second part addressed rabies epidemiological surveillance:
- Recommended actions and prohibitions when encountering a biting dog (prohibitions against killing, isolating, or tethering this biting dog);
- People to inform in the event of a dog bite (Fokontany chiefs, law enforcement, medical staff, veterinarians, or livestock technicians);
- People authorized to isolate the biting dog (the owner if known, or the Fokontany chief if the owner is unidentified);
- Responsibilities of the veterinarian about a biting dog (observing the dog for fifteen days, sampling its tissues in case of death, and sending the samples to the Pasteur Institute of Madagascar).

During the Endline survey, as respondents were asked if they saw rabies awareness tools during the last three months, we were able to ask more about these tools. The awareness tools used in this study were seen by 291 (86.3% of the 337) of respondents. Among them, 85.9% (250/291) watched the video spot. For printed media, 63.2% (184/291) saw the posters, and 47.7% (139/291) received our flyers about rabies. Only 13.4% (39/291) of the participants were reached by the local radio messages on rabies we broadcast over the study area.

Discussion:-

This study aimed to understand if awareness campaigns can improve communities' knowledge, attitudes, and practices on rabies through operational research activities in Menabe region of Madagascar.

Most study participants are literate and Sakalava, the main ethnic group of the region (Alain, 2015). Dog ownership rate was lower than in other studies, such as in the Philippines (76%) (Dalvin et al., 2014), Grenada (52.3%) (Glasgow et al., 2019), Ethiopia (48.4%) (Kabeta et al., 2015), and Zimbabwe (49%) (Spargo et al., 2021). One reason for this difference is that dogs are not particularly liked by some participants in our study (182) and they are also sometimes taboo by some of them. This is in contradiction with the Kuujjuaq community, who considers dogs part of their identity and family tradition (Brunet et al., 2017).

Our study results indicated that the participants KAP level was lower at Baseline compared to what was found in the literature. This could be attributed to many reasons such as the absence of a community-based health education project, the dog management ignorance due to taboos, and trust in traditional healers' practices. The presence of traditional treatments is sometimes a reason for not seeking medical care, similar to the case in Asia (Awuni et al., 2019; Ntampaka et al., 2019). The KAP level increases like in our study with the presence of rabies health programs (Matibag et al., 2009).

During the Endline, rabies was already known by most (96.4%) of the participants. The first sources of information were neighbors. This may be attributed to social relationship and sharing information between people in their communities, after being aware of rabies. A study conducted in Sri Lanka had similar results, where 94.5% of participants had already heard of the disease after an awareness campaign (Matibag et al., 2009). Whether in the

Baseline or the Endline, most of the participants first time heard about rabies from their relatives. This situation underscores the importance of exposing communities to awareness campaigns, enabling them to educate others.

Interestingly, the participants' KAP average score during the second phase is twice more important than their KAP average before the awareness campaign, demonstrating that awareness campaign can significantly increase participants' KAP level. Other studies conducted in Sri Lanka and Azerbaijan showed a similar increase in the KAP level regarding rabies after an awareness campaign (Matibag et al., 2009; Hasanov et al., 2017).

As a limitation, this study could have been designed as a case-control study if the study area were larger and participants were farther apart to better capture the scope of the tools. Moreover, a multilevel logistic regression would have allowed for a direct examination of the random effect of Fokontany.

Conclusion:-

This study assessed the knowledge, attitudes, and practices of the population, implemented many communication tools, identified the tools that most reached people, and evaluated its own results. While some tools have a broader reach, the complementarity of these tools remains a better approach to reach many people to raise their awareness about rabies. However, future studies are needed at the territorial scale to generalize our findings.

Conflict of interest

All authors hereby declare no conflict of interest. The authors declare that this research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Ethics issues

No ethical issues. This study received approval from the local administrative and health authorities. There was no risk for study participants during the application of the research. Oral and written consent were obtained from all participants involved in the study. Confidentiality and anonymity were assured. Participants had the right to refuse to participate or withdraw from the study without any rationale at any time. The questionnaires were administered to households, and each participant was informed of the study objectives, their voluntary participation, and their right to withdraw from the study if desired.

Author contributions

Daouda Kassié (DK) and Volatiana Randriafaraniaina (VR) contributed to the conception, design, the study implementation and data analysis; DK, VR, Arlette Florine Ravolatsara (AFR), Vincent Michel Rakotoharinome (VMR) performed the data collection; DK, VR, Arlette Florine Ravolatsara (AFR), Vincent Michel Rakotoharinome (VMR) and Eric Cardinale reviewed the results; DK wrote the first draft of the manuscript; All authors contributed to review the draft of the manuscript and wrote sections of it. All authors contributed to the manuscript revision, read and approved the submitted version.

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References:-

1. Aiyedun, J.O., Oludairo, O.O., &Olorunshola, I.D. (2017). Roles of wildlife in epidemiology of rabies: A mini-review. Journal of Advanced Veterinary and Animal Research, 4, 117-124.
2. Andriamandimby, S.F., Héraud, J., Ramiandrasoa, R., Ratsitorahina, M., Rasambainarivo, J.H., Dacheux, L., Lepelletier, A., Goodman, S.M., Reynes, J.M., &Bourhy, H. (2013). Surveillance and control of rabies in La Reunion, Mayotte, and Madagascar. Veterinary Research, 44, 77 - 77.

3. Awuni B, Tarkang E, Manu E, Amu H, Ayanore M, Aku F, et al. (2019). Dog owners' knowledge about rabies and other factors that influence canine anti-rabies vaccination in the Upper East region of Ghana. Tropical medicine and infectious disease. 4(3): 115.
4. Brunet P, Lévesque F. (2017). Dynamiques culturelles et représentations sociales du chien dans la communauté inuite de Kuujjuaq (Nunavik). Études Inuit Studies. 41(1-2): 265-83.
5. Chernet, B. (2016). Review of Rabies Preventions and Control. Journal of Medicine, Physiology and Biophysics, 23, 45-52.
6. Davlin S, Lapiz S, Miranda M, Murray K. (2014). Knowledge, attitudes, and practices regarding rabies in Filipinos following implementation of the Bohol Rabies Prevention and Elimination Programme. Epidemiology & Infection. 142(7): 1476-85.
7. Fooks, A.R., Banyard, A.C., Horton, D.L., Johnson, N., McElhinney, L.M., & Jackson, A.C. (2014). Current status of rabies and prospects for elimination. Lancet (London, England), 384, 1389 - 1399.
8. Giezendanner F.(2012). Taille d'un échantillon aléatoire et marge d'erreur. Instruction Publique, Culture et Sport. 7: 1-22.
9. Glasgow L, Worme A, Keku E, Forde M.(2019). Knowledge, attitudes, and practices regarding rabies in Grenada. PLoS Negl Trop Dis.13(1): e0007079
10. Hampson K, Coudeville L, Lembo T, Sambo M, Kieffer A, Attlan M, et al. Estimating the global burden of endemic canine rabies (2015). PLoS Negl Trop Dis. 2015 Apvril ; 9(4): 1-21.
11. Hasanov, E.E., Zeynalova, S., Geleishvili, M., Maes, E., Tongren, E., Marshall, E., Banyard, A.C., McElhinney, L.M., Whatmore, A.M., Fooks, A.R., & Horton, D.L. (2017). Assessing the impact of public education on a preventable zoonotic disease: rabies. Epidemiology and Infection, 146, 227 - 235.
12. Kabeta T, Gelalcha B, Tigre W, Ward M, Mor S. (2015). Knowledge, Attitudes and Practices of Animal Bite Victims Attending an Anti-rabies Health Center in Jimma Town, Ethiopia. PLoS neglected Tropical Diseases. 9(6): 1-14.
13. Kassié, D. (2023, novembre 15). Awareness campaign video for local communities: Understanding and Preventing Rabies in the Menabe Region, Madagascar. Zonodo. https://doi.org/10.5281/zenodo.10136669
14. Kassié, D., Randriafanaraniaina, V., Rakotoarinome, V. M., & Ravolatsara, A. F. (2023). Local Solutions Towards Rabies-Related Human Mortality Elimination by 2030 in the Menabe Region (Madagascar). Journal of Alternative and Complementary Medicine, 7(5), 773 778. https://doi.org/10.5281/zenodo.10143213
15. Leblanc C.(2019). Rabies in Madagascar: A three-pronged survey of knowledge and Practices among health care providers rom anti-rabies treatement centers, vétérians and the community of Moramanga. [Thèse]. Risque infféctieux; Paris;.102p.
16. Matibag G, Ohbayashi Y, Kanda K, Yamashina H, Kumara W, Perera IG, et al. (2009). A pilot study on the usefulness of information and education campaign materials in enhancing the knowledge, attitude and practice on rabies in rural Sri Lanka. The Journal of Infection in Developing Countries. 3(01): 055-64.
17. Meng S, Sun Y, Wu X, Tang J, Xu G, Lei Y, et al. (2011) Evolutionary dynamics of rabies viruses highlights the importance of China rabies transmission in Asia. Virology. 2011 Février ; 410(2) : 403-9.
18. Morvan, J., Rakoto-Andrianarivelo, M., Randriamihoatra, S., & Roux, J.F. (1993). [Situation of endemic rabies in Madagascar]. Archives de l'Institut Pasteur de Madagascar, 60 1-2, 5-8 .
19. Nobel D, Cleaveland S, Coleman P, Fèvre E, Meltzer M, Miranda M, et al. (2005). Reevaluating the burden of rabies in Africa and Asia. Bull World Health Organ. 2005 Mai; 83(5): 360-8.
20. Ntampaka P, Nyaga P, Niragire F, Gathumbi J, Tukei M. (2019). Knowledge, attitudes and practices regarding rabies and its control among dog owners in Kigali city, Rwanda. PLoS One.14(8): 1-15.
21. Okonko, I.O., Adedeji, O.B., Babalola, E.T., Fajobi, E.A., Fowotade, A.A., & Adewale, O.G. (2010). Why Is There Still Rabies in the World? - An Emerging Microbial and Global Health Threat.
22. Rajeev M, Edosoa G, Hanitriniaina C, Andriamandimby S, Guis H, Ramiandrasoa R, et al.(2018). Healthcare utilization, provisioning of post-exposure prophylaxis, and estimation of human rabies burden in Madagascar. Vaccine. 2018 Novembrer ; 35- 44.
23. Rajeev, M., Edosoa, G.T., Hanitriniaina, C., Andriamandimby, S.F., Guis, H., Ramiandrasoa, R., Ratovoson, R., Randrianasolo, L., Andriamananjara, M., Héraud, J., Baril, L., Metcalf, C.J., & Hampson, K. (2018). Healthcare utilization, provisioning of post-exposure prophylaxis, and estimation of human rabies burden in Madagascar. Vaccine, 37 Suppl 1, A35 - A44.
24. Rajendra Singh, Karam Pal Singh, Susan Cherian, Mani Saminathan, Sanjay Kapoor, G.B. Manjunatha Reddy, Shibani Panda & Kuldeep Dhama. (2017). Rabies – epidemiology, pathogenesis, public health concerns and advances in diagnosis and control: a comprehensive review, Veterinary Quarterly, 37:1, 212-251, DOI: 10.1080/01652176.2017.1343516

25. Randriafaraniaina V.(2022). Impact de la sensibilisation sur les connaissances, attitudes et pratiques sur la rage dans la régionMenabe,Madagascar: 2020-2021.. 2022. Thèse de doctorat : Médecinevétérinaire : Université d'Antananarivo142 p.https://agritrop.cirad.fr/602354/
26. Reynes, J.M., Andriamandimby, S.F., Razafitrimo, G.M., Razainirina, J., Jeanmaire, E.M., Bourhy, H., & Héraud, J. (2011). Laboratory Surveillance of Rabies in Humans, Domestic Animals, and Bats in Madagascar from 2005 to 2010. Advances in Preventive Medicine, 2011.
27. Ribadeau Dumas, F., Haddad, N., & Gautret, P. (2016). Post-exposure prophylaxis against rabies is still needed after a bite from a vaccinated animal. BMJ : British Medical Journal, 352.
28. Schnell, M. J., J. P. McGettigan, C. Wirblich and A. B. Papaneri (2010). The cell biology of rabies virus: using stealth to reach the brain." Nature Reviews Microbiology 8: 51-61.
29. Schnell, M. J., J. P. McGettigan, C. Wirblich and A. B. Papaneri (2010). The cell biology of rabies virus: using stealth to reach the brain. Nature Reviews Microbiology 8: 51-61.
30. Spargo RM, Coetzer A, Makuvadze FT, Chikerema SM, Chiwerere V, Bhara E, et al. (2021). Knowledge, attitudes and practices towards rabies: A survey of the general population residing in the Harare Metropolitan Province of Zimbabwe. PloS one. 16(1): 1-15.
31. WHO. Expert Consultation on Rabies. Geneva: World Health Organization. 2012.
32. Yang, D., Kim, H., Lee, K., & Song, J. (2013). The present and future of rabies vaccine in animals. Clinical and Experimental Vaccine Research, 2, 19 - 25.