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The Role of Dog Population Management in the Context of Rabies Eradication (Case Study in Pejeng Village, Tampaksiring District, Gianyar Regency, Bali Province)

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Abstract: This research aims to find out all changes in knowledge, attitudes, and dog ownership management in the Pejeng Village community following the implementation of Dog Population Management pilot project conducted by the Government of Indonesia and FAO. This research applied aqualitative method using a cross-sectional design. The total population was 1434 people, which is the number of all families in Pejeng Village. The sampling technique is a proportional stratified sampling technique that filtered the number of samples used to 313 respondents (by Slovin, 5% error tolerance) consisting of 63 Intaran residents, 54 Pande residents, 70 Puseh residents, 55 Guliang residents, 37 Pedapdapan residents, and 34 Panglan residents. The research instrument was a questionnaire, then the results of the interviews were tabulated using Microsoft Excel 2013 program then analyzed descriptively by the SPSS program and analyzed by non-parametric analysis using the Wilcoxon test. The results showed that the implementation of dog population management has significantly changed the knowledge, attitudes, and dog ownership management in the Pejeng Village community.

Keywords:Changes in knowledge, attitudes, dog ownership management, dog population management, rabies.

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I. INTRODUCTION

Rabies is spread across all continents and become endemic in most African and Asian countries. Rabies is a deadly zoonotic viral disease, transmitted to humans through contact (especially bites and scratches) from infected animals, both domestic and wild. Rabies is estimated to cause at least 55,000 deaths per year worldwide, about 56% of which occur in Asia and 44% in Africa, particularly in rural areas of both continents. The estimated annual cost of treating rabies is the US $ 583.5 million, specifically for post-exposure prophylaxis (PEP). An estimated 10 million people worldwide receive post-exposure prophylaxis after exposure to animals with suspected rabies (WHO, 2001).

In Bali, rabies cases started in the southern region of Bali Island then spread throughout Bali (Susilawathi et al 2012). Bali Government, the central government and FAO have worked closely to eradicate rabies through mass dog vaccination and the Communication, Information and Education (EIC) program since the first rabies outbreak in Bali. These methods have significantly led to a decrease of rabies positive cases but have not been able to free Bali from rabies yet. From January to August 2018, there were 105 cases of positive rabies in dogs along with 3 human deaths (Livestock and Animal Health Services, Bali Province, 2018).

One of the reasons why rabies in Bali is still not successfully eradicated is because of many stray dogs that have not been vaccinated. Vaccination coverage is less than the target due to the attitude of citizens in Bali who allowtheir dogs to roam around causing difficultyin handling the dog population, which keeps increasing. The high population of free-roaming or stray dogs significantly affects vaccination coverage. Insufficient vaccination coverage will not break the cycle of rabies spread in Bali. Therefore,it is necessary to apply an effective method to increase the public awareness related to dog population management and understanding the health situation of stray dogs, and therefore it will reduce the spread of rabies.

The approach which is expected to be able to solve this issue is called Dog Population Management (DPM) or in Indonesia, it is called as "Manajemen Populasi Anjing". This approach aims to stabilize the dog population. Scientific evidence and proven experience from other countries towards Dog Population Management have shown that a comprehensive Dog Population Management approach has an essential impact for maintaining the effectiveness of mass dog vaccination campaigns, sustainably reducing rabies outbreaks and also ensuring the well-being of dogs and communities. In the long term, Dog Population Management approach will also encourage a more responsible approach to dog ownership (FAO, 2016).

Pejeng Village was selected as the pilot village for the Dog Population Management method. In this program, there are six components thatare projected to be effective in controlling rabies including education, legislation, registration and identification, vaccination, sterilization, and waste management. It is expected that with the Dog Population Management implementation, there will be changes in people's knowledge, attitudes, and ways of raising dogs and improve responsible dog ownership to eradicate rabies in Bali. The Dog Population Management pilot project was implemented in 2016 in cooperation with all relevant stakeholders. This research assessed the changes in knowledge, attitudes, and ways of raising dogs in Pejeng Village community following the DPM pilot project implementation.

II. LITERATURE REVIEW AND RESEARCH CONCEPT

Dog Ecology

The dynamics of dog population have a major impact on the effectiveness of rabies control strategies. Thus, understanding the ecology of domestic dogs has been recognized as central to effective design in the rabies control program (Cleveland et al 2006; Hsu et al 2003; Slater, 2001).

The existing dog population in Bali can be divided into domestic, confined and free-roaming or stray populations. Many other countries infected with rabies also experience the same stray dog problem due to the owner's attitude in roaming their dogs freely. In some areas where the dog population is largely free-roamed, the size of dog metapopulation is an important predictor of the probability of rabies transmission.

Dibia et al (2015) explained that several researchers have examined the risk factors, which are believed to influence the rabies incidence, namely the vaccination status of dogs (De-Jong and Bouma, 2001; Cleveland et al 2003; Kamil et al 2004), the dogs care system (Sudardjat, 2003; Kamil et al 2004), dog owner's knowledge (Wattimena and Suharyo, 2010), dog mobility (Zhang et al 2006; Akoso, 2007), dog population density (Soenardi, 1984; Mattos et al 1999, Keuster and Butcher, 2008), the socio-cultural community (Mattos et al 1999) and the socio-economic community (Widdowson et al 2002; Flores-Ibarra and EstrellaValenzuela, 2004).

Rabies

Rabies is an acute infectious animal disease caused by a virus and could be transmitted to humans. Therefore, rabies is categorized as a zoonotic disease (Dharmawan, 2009). Rabies is zoonotic, meaning that this disease could be transmitted from animals to humans (Alves et al 2003) and can cause death in humans with a CFR (Case Fatality Rate) of 100%. Rabies virus would be released through the saliva of infected animals and spread from its bite or licking wounds (Kienzle, 2007). Generally, the rabies virus is resistant to heating in a certain degree of heat. The rabies virus could live for several weeks at 4 ˚C. at temperatures below 0˚C and will live longer in a state without CO2. At room temperature, with the addition of glycerol, it could stay until several weeks while in the frozen state the rabies virus will last for years. In saliva with hot air temperature, it could last for 24 hours with a half-life of approximately 4 hours on temperature 40˚C and 30 seconds at 60˚C (Akoso, 2007; Wunner 2002).

Rabies Control and Eradication Strategy

Considering the ecology of dogs in Bali and the proximity of dogs to the community, rabies eradication programs should be optimized by applying a cultural/social approach as discussed (Putra, et al. 2009). Many valuable lessons or experiences that could be learned, low community support for eradication programs and lack of understanding towards dogs' ecology are important factors, which could determine the success of rabies control programs. To overcome this problem, it is necessary to consider using a vaccine that can provide long-acting protective antibodies as previously discussed, as well as a more effective rabies elimination strategy through improved vaccination coverage, reporting, education and paying attention to animal welfare issues as well.

The Level of Public Knowledge about Rabies

The level of knowledge and behavior of the community towards rabies is influenced by several factors including habits and culture of the community, which tend to be unaware of rabies prevention and vaccination, limited access to information and lack of public education (Hoetama et al 2016). Pet owners in urban areas tend to be more cooperative with rabies control activities. The attitudes and practices of respondents may reflect the inaccessibility of facilities and lack of services that would allow community participation in rabies control (Matibag et al 2014).

Dog Population Management

In 2007, International Companion Animal Management Coalition (ICAM) published the first dog population management guidelines and suggested a comprehensive approach of DPM. DPM program has provided an effective and humane alternative compared tothe previous approaches such as the common dog

confiscation and elimination. DPM includes vaccination, sterilization, and education that have been well-received and accepted by Colombo Municipal Council (CMC) and the local community maintains the program supported by local governments from 2012 onwards. The impact on human health and animal welfare has been positive, particularly with the decrease in dog rabies cases from previous annual fluctuations starting 2008 (Eckman, 2015).

Theoretical Framework

Pejeng Village is one of the villages in Gianyar Regency, which was historically free of rabies, but in 2010 there were 3 positive cases of rabies in dogs, 1 in 2012, and 1 in 2016. All dogs diagnosed with positive rabies were free-roamed pet dogs (DPPK Gianyar, 2016).

Pejeng Village was selected as a pilot village to implement the six components of DPM because Pejeng Village is located in the border of rural and urban areas where the community still have high solidarity and commitment to eradicating rabies. However, the public knowledge of rabies, attitudes, and ways of caring for their dogs are still at high risk of contracting rabies.

These six components of Dog Population Management that were tested in Pejeng Village in 2016 included: education, legislation, registration and identification, vaccination, sterilization and waste management. With the implementation of these six components of comprehensive Dog Population Management, it is hoped that there will be changes in community knowledge, attitudes, and ways of raising dogs to prevent from rabies, therefore this research will evaluate the changes of knowledge, attitudes and ways of raising dogs in Pejeng Village community after the introduction of the Dog Population Management program.

Research Concept

The research concept could be drawn as follows:

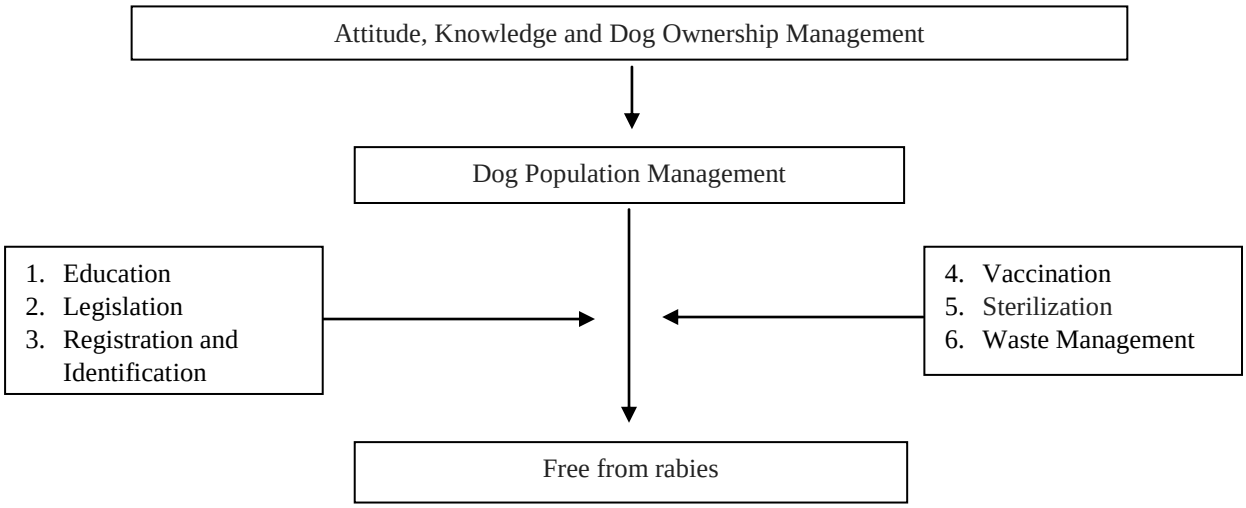

Figure 1. Research Concept

Hypothesis

The research hypothesis was: "The Implementation of Dog Population Management will change the knowledge, attitudes, and dog ownership management in Pejeng Village Community".

III. RESEARCH METHODS

This research is a cross-sectional study, which used a certain time dimension. This research was conducted in Pejeng Village, Tampaksiring District, Gianyar Regency, Bali Province consisting of 6 Banjars namely, Intaran, Puseh, Pande, Guliang, Pedapdapan and Panglan. This research was conducted twice, specifically in November 2016 before the dog population management program was implemented and in September 2018 after the dog population management program was implemented

This research evaluated the impacts related to the implementation of Dog Population Management on knowledge, attitudes, and dog raising management in Pejeng Village community. The data obtained from direct observation and interviews with the residents using questionnaires. The interviews were conducted directly by visiting residents' houses in each banjar included in this research population sampling. The population in this research amounted to 1434 people, which is the number of all families in Pejeng Village. The sampling technique used the proportional stratified sampling technique, whereas the number of samples used in this

research has been filtered to 313 respondents by (Slovin, 5% error tolerance) consisting of 63 Intaran residents, 54 Pande residents, 70 Puseh residents, 55 Guliang residents, 37 Pedapdapan residents and 34 Panglan residents.

The research instrument was a questionnaire. The data were tabulated from interviews using Microsoft Excel 2013 program, then analyzed descriptively by the Statistical Product and Services Solution (SPSS.24) program for Windows. The results before and after the implementation of Dog Population Management were analyzed by non-parametric analysis with the Wilcoxon test.

IV. RESULTS AND DISCUSSION

Socio-demographic Characteristics of Respondents

Based on the results of the interviews with 313 respondents, the majority of respondents were male as many as 297 people (94.89%), aged between 45-54 years (30.99%), had 3-4 family members (42.49%), work as entrepreneurs (26.52%), earn an income of <1.5 million/month (40.89%) and own a type of house with limited walls in total (94.57%). It can be concluded that the majority of respondents were men who were entering retirement age and have large family burdens/responsibilities, and below-average income, so they have a tendency to be indifferent to the surrounding environment due to their economic limitations. The situation made them abandoned their pets, especially pet dogs that became free-roaming without proper control of movement.

Public Knowledge about Rabies Before and After the Implementation of Dog Population Management

Rabies is not a strange word to the residents of Pejeng Village. In 2016 there were 268 respondents (85.62%) stated that they had heard about rabies and in 2018 it was increased to 308 respondents (98.40%). This data shows that Dog Population Management pilot project has a significant role ($P < 0.05$) in increasing public knowledge about rabies. The spread of rabies in Indonesia is closely related to public understanding, awareness, participation and behavior. Public knowledge and understanding of controlling and eradicating rabies is a very important aspect.

In 2016, 254 respondents knew about the dangers of rabies (81.15%) and it increased in 2018 to 304 respondents (97.12%). This data indicates that the Dog Population Management pilot project plays a significant role ($P < 0.05$) in increasing public knowledge about rabies. Communication, information and education (IEC) activities were expected to be able to increase public knowledge and understanding of the dangers of rabies so they would be more responsible for the dogs that they cared for (Yousaf et al, 2012).

In 2016, 237 respondents (75.72%) recognized that free-roaming dog is the source of rabies transmission andin 2018 it was increased to 273 respondents (87.22%). This data indicates that the Dog Population Management pilot project plays a significant role ($P < 0.05$) in increasing public knowledge about rabies. The interaction between free-roaming dogs has caused quick rabies virus transmission from one dog to another. If there is a fight between dogs and one of the dogs is a rabies carrier, a healthy dog will likely have that rabies as well (Gilang, 2015). Contact between domestic dogs and other dogs is a risk factor that has a significant impact on rabies transmission (Dibia et al. 2015). Based on this data, the Dog Population Management in Pejeng Village needs to be implemented with the registration and identification component, and dog owners should report when there is dog movement (in and out) from Pejeng Village and when dogs are free-roamed, their identity and origin would be soon identified.

Respondents in 2016 who knew the importance of rabies vaccination in dogs were 273 respondents (87.22%) and were increased in 2018 to 310 respondents (99.04%). The data reveal that the Dog Population Management pilot project plays a significant role ($P < 0.05$) in increasing public knowledge about rabies. The strategy for controlling and eradicating rabies in animals was commonly conducted through vaccination activities (Putra, 2012). Rabies Transmitted Animals (HPR) that are not vaccinated are more likely to contract rabies than HPR which have been vaccinated (Pasek, 2012). Unmanaged dog ownership and HPR vaccination status play an important role in the high cases of HPR bites in humans (Tioho, 2009).

In 2016 the respondents' answers to the question of how to prevent rabies in dogs were very diverse, those who answered the rabies vaccination were 199 respondents (63.58%) while in 2018 those answers were more homogeneous. The number of respondents answered rabies vaccination was 303 respondents (96.81%), which is an increase of 33, 23%. This data reveals that the Dog Population Management pilot project plays a significant role ($P < 0.05$) in increasing public knowledge about rabies. Dog Population Management in Pejeng Village also implemented mass dog vaccination and sterilization components. The activities were assisted by related local non-governmental organizations (NGOs) and Indonesian Veterinary Medicine Association (PDHI), Bali Branch, which aimed to vaccinate all dogs in the Pejeng Village area and to stabilized the dog population. Sterilization was conductedon stray dogs and those dogs that belonged to residents who did not want to have any additional dogs.

The education component in Dog Population Management which is implemented in Pejeng Village started by the establishment of Rabies-Free Cadres with 20 members of Pemberdayaan Kesehatan Keluarga (PKK) members who are also cadres of Pos Pelayanan Terpadu (Posyandu), and Juru Pemantau Jentik

(Jumantik). The Rabies-Free Cadres were given training to become resource persons for socialization and handling bite cases. During theDPM implementation, the 20 Rabies-Free Cadres provided outreach activities to the community members. In addition to the Rabies Free Cadre, trainings were also given for school teachers aimed to enhance their capability to socialize information related to the dangers and efforts to eradicate rabies to their students. To ensure the sustainability of socialization in schools, coordination has also been carried out with the Gianyar Regency Education Office to include rabies education as a "hidden curriculum" in some subjects. The village youths were also provided with training to become more creative in socializing the dangers and efforts to eradicate rabies. One of their creativities was the creation of ogoh-ogoh with the theme of the rabies dangers and art performance in the form of Prembon. With this community empowerment, it is hoped that education could be carried out independently and sustainably.

Public Attitudes to Eradicate Rabies Before and After the Implementation of Dog Population Management

In 2016, respondents' answers regarding proper post-exposure prophylaxis, washing wounds, and going directly to the Community Health Center (Puskesmas) were still low (32.27%) but in 2018 it had increased to 88.18%. This data reveals that the DPM pilot project plays a significant role ($P < 0.05$) in changing the community attitudes to eradicate rabies. Washing rabies-infected wounds with soap and water will increase survival up to 50% (Radostits et al 2007).

From respondents' answers in 2016, there were 257 respondents (82.11%) who already knew the importance of Anti-Rabies Vaccine/Anti-Rabies Serum, and in 2018 it increased to 312 respondents (99.68%). These data indicate that the DPM pilot project plays a significant role ($P < 0.05$) in changing people's attitudes to eradicate rabies. Preference for traditional medicine may occur from many factors including easy access to traditional medicine, lack of awareness, and long duration of treatment. Dependence on traditional medicines with proven efficacy is very risky and nothing can be done to save a person's life after the first symptoms of the disease appear. Once rabies virus is suspected or proven, the immediate use of an efficient anti-rabies vaccine (VAR) with proper wound management and simultaneous administration of rabies immunoglobulin is almost always effective in preventing rabies (WHO, 2005).

In 2016, there were only 3.83% of respondents that answered the most appropriate handling of biting dogs that they should be tied/confined then report to officials while in 2018 it increased to 37.06%. This data implies that the DPM pilot project plays a significant role ($P < 0.05$) in changing the community attitudes in the efforts to eradicate rabies. Handling a dog that bites is very important because it is related to the availability of data to support disease diagnosis. The rabies diagnostic procedure is carried out if there are reports of cases of bites to humans or potential cases that cause rabies (Trimarchi and Smith, 2002). To obtain a high degree of accuracy in conducting field diagnoses, the most appropriate way is to draw attention to the history of biting, the presence or absence of provocation, and the number of bite sufferers. Detention and clinical observation for 10-15 days are carried out on dogs, cats, although they seem so healthy but known to have bitten people. Based on experience in the field, a dog that bites more than one person without any provocation would die during the observation period. Then the brain specimen is checked in the laboratory, if the result was rabies positive, then an indication of the tendency of rabies in the field without any provocation could be determined through the animal biting 1 person without provocation, the possibility of (positive) rabies was 25% and the animal biting 2 people without provocation of the possibility (positive) of rabies was 50 %. Meanwhile, an animal that bites 3 people without provocation, the possibility of (positive) rabies was 75% and an animal that bites 4 people without provocation was 100% possible (positive) for rabies (Directorate General of Livestock and Animal Health Service, 2015).

In 2016 there wasonly 7.67% of respondents answered that they took the most appropriate action against dogs with rabies symptoms by confining the dogs and then reported to officials and in 2018 it was increased up to 38.02%. This data reveals that the Dog Population Management pilot project plays a significant role ($P < 0.05$) in changing community attitudes to eradicate rabies. Dibia et al (2015) stated that dogs raised in poor conditions were three times more likely to be infected with rabies than dogs that were in healthy condition. Dog owners who have high attention to their pets tend to notice changes in behavior earlier on their dogs if they show symptoms of any illness (Suartha et al 2014). The initial symptoms that appear in dogs with rabies can be seen from changes of dog's behavior. Thus, owners' attention to their dogs plays an important role to prevent the spread of rabies (Nugraha, et al 2017).

According to the survey results in 2016, the people of Pejeng Village mostly still dispose of their household waste in the yard of their house (42.81%) and in 2018 there were 220 respondents (70,29%) the people of Pejeng Village started to dispose of their household waste in garbage collection places, which is). This data reveals that the DPM pilot project plays a significant role ($P < 0.05$) in changing community attitudes to eradicate rabies. Limited space for waste management (uncontrolled waste disposal) is a suitable place for several organisms and it attracts various animals such as flies and dogs which cause diseases (Yones, 2017).

Reducing access to food waste such as trash on streets, waste around slaughterhouses, butchers, and market areas and protecting landfills from scavengers have been suggested as a practical, inexpensive, and sustainable way to reduce the size of the free-roaming dog population (Wandeler, 1995). With the change of the attitude of Pejeng people of not disposing of their household waste in the yard, garden and other locations. They started to put waste into the Garbage Collection Site (TPS) making it easier for village officials to manage the waste and the environmentbecomes clean and it limits the source of food for stray dogs and eventually reduces the population of stray dogs in Pejeng Village as well.

Dog Ownership Management Before and After the Implementation of Dog Population Management Pilot

Based on the survey results in 2016, the number of respondents who raised dogs was 142 respondents (45.37%). From the survey results, the authors conducted further observation regarding the dog ownership managementbefore and after the implementation of Dog Population Management pilot project in Pejeng Village.

In 2016, there were 124 respondents who answered that their dogs had been vaccinated against Rabies (87.32%) and it increased in 2018 to 140 respondents (98.59%). The data shows that the DPM pilot project plays a significant role ($P < 0.05$) in changing the way dogs are treated to eradicate rabies. The public's attention to the prevention of rabies could be seen indirectly through the physical condition of the pet dogs by providing sufficient food, vaccination, the presence or absence of other HPR, health examination, the number of dogs kept, and interaction with other dogs, the type of food given. Prevention of rabies in dogs needs to be supported with proper and good treatment. If you know dogs very well, they will be very useful and become loyal friends and easy to take care of (Nugraha, 2017).

Based on 142 respondents' answers, there are still many people who raise dogs by roaming them freely in Pejeng Village, which is 100 respondents (70.42%) and was decreased in 2018 to 37 respondents (26.06%). These data imply if the Dog Population Management Program plays a significant role ($P < 0.05$) in changing the way dogs are cared for in efforts to eradicate rabies. The implementation of the legislation component in Dog Population Management, like the creation and enforcement of Perarem has started to change the way community dogs are kept in Pejeng Village, from being predominantly released to being properly managed. This is in accordance with the results of Prayoga's (2018) research indicating that Perarem implementation related to dog ownership management and rabies control has resulted changes of people's behavior in terms of the way they care their dogs, the movement and controlling the dog's health. Perarem could be interpreted as Paruman decisions (customary meetings) which have a binding force, which then agreed to be carried out accordingly (Parwata, 2007). Besides, there are also differences in community behavior in giving vaccinations and handling of bite cases when compared to villages that do not have Perarem. With this existence of Perarem, the community becomes more responsible in raising dogs because of the rules that bind them and all the sanctions for not complying.

According to the survey results, in 2016 the answers of respondents who could hold/handle their dogs were 136 respondents (95.77%) and it increased in 2018 by 141 respondents (99.30%). This data shows that the DPM plays a significant role ($P < 0.05$) in changing the way dogs are cared for in efforts to eradicaterabies. The method of feeding dogs in Pejeng Village by giving food was 135 respondents (95.07%) and it increased in 2018 to 141 respondents (99.30%). This data indicates that the DPM plays a significant role ($P < 0.05$) in changing the way dogs are cared to eradicate rabies. According to Murphy et al. (2007), a good type of feed will affect the health status of the animal. The condition of a dog with adequate nutrition and well-maintained stimulates the components of the immune system to develop perfectly so they could function it optimally. Dog nutrition can cause a low immune response. Animals with protein deficiency or certain amino acid deficiency cause them to be more susceptible to viral infections.

In 2016, there were 83 respondents (58.45%) who answered that dogs were raised in the yard of their house only and it increased in 2018 to 100 respondents (70.42%). This data indicates that the DPM plays a significant role ($P < 0.05$) in changing the way dogs are cared to eradicate rabies. The movement of dogs and from the origin of new breeds pose risk factors in the transmission of rabies. Dogs brought from outside the village, specifically from an infected village have a chance to be infected without knowing the health status of the new dogs, which have a risk of transmitting rabies in free rabies areas. Dogs from outside the village could be dogs that are infected with rabies and might still be in the incubation period when it is brought to their village. (Nugraha, 2017).

According to Jeany et al (2011), respondents with poor knowledge of responsible dogownership would give their dogs three times the risk of getting rabies compared to respondents with good knowledge of dog ownership. This could happen because dog owners with good knowledge find it easier to make the best decisions about how to take care of and handle dogs. Meanwhile, dog owners with poor knowledge find it difficult to raise a dog, especially if the pet always causes problems.

V. CONCLUSION AND SUGGESTION

According to the results and discussion as mentioned previously, it could be concluded that the implementation of DPM could change the knowledge, attitudes and dog ownership management in Pejeng Village community to be significantly better ($P < 0.05$).

The DPM program in Pejengshould be sustained to free Pejeng Villageand Bali from rabies. This needs involvement from all levels of societies, stakeholders and government in carrying out this program. It is recommended to establish DPM as a mandatory program at village level that eventually will change the community attitudes and behavior to enhance responsible dog ownership in the community and pay more attention to animal welfare issues. Therefore, the DPM program's achievement inPejeng Village should be replicated in other areas in Bali and across Indonesia to help eradicate rabies at the national and international levels by 2030.

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