

# **A Study on the Association between Number of Impounded Days and Adoption Rate of Stray Dogs at Public Animal Shelters in Changhua County, Taiwan**

**Meng-Chih Tung<sup>1,4</sup> Chang-Young Fei<sup>2</sup> Jeng-Tung Chiang<sup>3</sup> Kwong-Chung Tung<sup>1\*</sup>**

## *Abstract*

According to the adoption records of the animal shelter in Changhua county from 2004 to 2010, this study investigated if there was a statistically advantageous length of shelter stay, from the time when dogs impounded until their adoption. The adoption records during this period of time showed that a total of 1,533 dogs were adopted. The number of days for dogs to be impounded was divided into different categories and the adoption rate (number of dogs in each category divided by the total number of dogs being adopted) was calculated. Statistical analyses were performed to investigate the association between the number of days of impoundment and the adoption rate. The nonparametric Kruskal-Wallis Test was used to perform the analyses, in which the numbers of impoundment days were divided into three categories: 0-6 days, 7-13 days, and over 13 days. The association between these three categories and the adoption rate was tested. The results of the test showed that the adoption rate of dogs impounded for 7-13 days was significantly higher than those impounded for other lengths of time. It was concluded that the adoption rate of dogs being impounded for 7-13 days was the highest.

---

**Keywords:** adoption rate, animal shelter, suitable impoundment days, Taiwan

---

<sup>1</sup>Department of Veterinary Medicine, College of Veterinary Medicine, National Chung Hsing University, No 250 Kuo Kuang Road, Taichung City, 40227 Taiwan, ROC

<sup>2</sup>School of Veterinary Medicine, National Taiwan University, No 1, Sec 4, Roosevelt Rd, Da'an Dist, Taipei, 10617 Taiwan, ROC

<sup>3</sup>Department of Statistics, National Chengchi University, No 64, Sec 2, ZhiNan Rd, Wenshan Dist, Taipei, 11605 Taiwan, ROC

<sup>4</sup>Animal Disease Control Center of Changhua County, No 2, Chungiang Rd, Changhua County, 50093 Taiwan, ROC

\*Corresponding author: E-mail: kctung1@dragon.nchu.edu.tw

## บทคัดย่อ

การศึกษาความสัมพันธ์ระหว่างจำนวนวันที่สุนัขถูกกักขังกับอัตราการรับไปเลี้ยงของสุนัขจรจัดในแหล่งพักพิงสุนัขสาธารณะ ในมณฑล Changhua ประเทศไต้หวัน

Meng-Chih Tung<sup>1,4</sup> Chang-Young Fei<sup>2</sup> Jeng-Tung Chiang<sup>3</sup> Kwong-Chung Tung<sup>1\*</sup>

การศึกษานี้ทำการศึกษาทางสถิติถึงความสัมพันธ์ระหว่างระยะเวลาที่สุนัขจรจัดพำนักในแหล่งพักพิงสุนัขสาธารณะกับอัตราการรับเลี้ยง โดยใช้ข้อมูลจากระเบียนสุนัขของแหล่งพักพิงสุนัขสาธารณะ ในมณฑล Changhua ระหว่างปี ค.ศ. 2004 ถึง 2010 จากข้อมูลพบว่า ในระหว่างช่วงที่ทำการศึกษามีจำนวนสุนัขทั้งหมด 1,533 ตัวที่ถูกรับเลี้ยง จำนวนวันที่สุนัขอยู่ในแหล่งพักพิงได้จัดแบ่งออกเป็นกลุ่มต่างๆ และอัตราการรับเลี้ยง (คำนวณจากจำนวนสุนัขในแต่ละกลุ่มหารด้วยจำนวนสุนัขทั้งหมดที่ถูกรับเลี้ยง) เพื่อหาความสัมพันธ์ทางสถิติระหว่างจำนวนวันที่สุนัขถูกกักขังกับอัตราการรับไปเลี้ยง วิธีการทางสถิติที่ใช้ เป็นแบบ nonparametric ได้แก่ Kruskal-Wallis และ Friedman โดยจำนวนวันที่สุนัขอยู่ในแหล่งพักพิง แบ่งออกเป็น 3 กลุ่ม ได้แก่ 0-6 วัน 7-13 วัน และมากกว่า 13 วัน จากการวิเคราะห์ทางสถิติทั้งสองรูปแบบพบว่า อัตราการรับเลี้ยงในสุนัขกลุ่ม 7-13 วัน มีค่าสูงสุด และสูงกว่าสุนัขกลุ่มอื่นๆ

**คำสำคัญ:** อัตราการรับไปเลี้ยง แหล่งพักพิงสุนัข จำนวนวันที่เหมาะสมที่สุนัขจรจัดพำนัก ไต้หวัน

<sup>1</sup> Department of Veterinary Medicine, College of Veterinary Medicine, National Chung Hsing University, No 250 Kuo Kuang Road, Taichung City, 40227 Taiwan, ROC

<sup>2</sup> School of Veterinary Medicine, National Taiwan University, No 1, Sec 4, Roosevelt Rd, Da'an Dist, Taipei, 10617 Taiwan, ROC

<sup>3</sup> Department of Statistics, National Chengchi University, No 64, Sec 2, ZhiNan Rd, Wenshan Dist, Taipei, 11605 Taiwan, ROC

<sup>4</sup> Animal Disease Control Center of Changhua County, No 2, Chungiang Rd, Changhua County, 50093 Taiwan, ROC

\*ผู้รับผิดชอบบทความ E-mail: kctung1@dragon.nchu.edu.tw

## Introduction

Animal shelters are established in order to provide stray animals in communities with a temporary shelter. After animals are impounded, they will face many impacts, such as unfamiliar environment, a monotonous lifestyle, crowded spaces and the menace of infectious diseases, which all directly influence their welfare in the shelters and indirectly influence the animal adoption rate. Weng et al. (2006) found that, in Taiwan, nearly 80% of the respondents were aware of the existence of animal shelters in their communities; however, only 20% of them had visited animal shelters. Moreover, among respondents who had visited animal shelters, only 30% of them were satisfied with the environment and service of animal shelters. They concluded that most Taiwanese do not have a high concern about but are dissatisfied with animal shelters. Unfortunately, society seldom pays attention to such an issue, and there is a general lack of public empathy for the animals suffering in animal shelters. Consequently, animal shelters are marginalized from society (Zawistowski and Morris, 2004). Because animal shelters in Taiwan have limited space and resources, the best policy for efficiently using limited resources is to reduce the length of impoundment. From the

perspective of animal welfare, after animals are impounded, the best ending for them is to find a new owner (Wells and Hepper, 2000). Therefore, it is necessary to manage the maximum number of dogs impounded and the minimum days of being impounded. This study attempted to explore if there is a statistically advantageous number of days to be impounded, from the time when animals are impounded until adoption, based on the adoption records from the animal shelter in Changhua county from 2004 to 2010.

## Materials and Methods

According to the records from the log of the animal shelter in Changhua county from 2004 to 2010, the adopted dogs were divided into different groups based on the number of impoundment days. Moreover, the percentage and cumulative percentage of the number of dogs in each group as well as the total number of adopted dogs were calculated, as shown in Table 1. A diagram was drawn up based on Table 1 to obtain curves concerning the number of impoundment days and the adoption rate. The association between the number of impoundment days and the adoption rate was investigated by analyzing the curves and performing statistical analyses. The nonparametric Kruskal-Wallis Test

(Berenson et al., 2009) was used, in which the number of impoundment days was divided into three categories: 0-6 days, 7-13 days, and over 13 days. The association between these categories and the adoption rate was tested. The association was determined based on  $p$ -value.

### Results

This study collected the records of 1,553 adopted dogs at the public animal shelter in Changhua County from 2004 to 2010. Table 1 was developed based on the number of impoundment days, the number of adopted dogs, the adoption rate, the cumulative number of adopted dogs, and the cumulative adoption rate. According to the data in Table 1, a diagram (Fig 1) was drawn up based on the number of impoundment days, the daily adoption rate, and the cumulative adoption date. As shown in Figure 1, the adoption rate of the dogs impounded for 7-13 days was the highest.

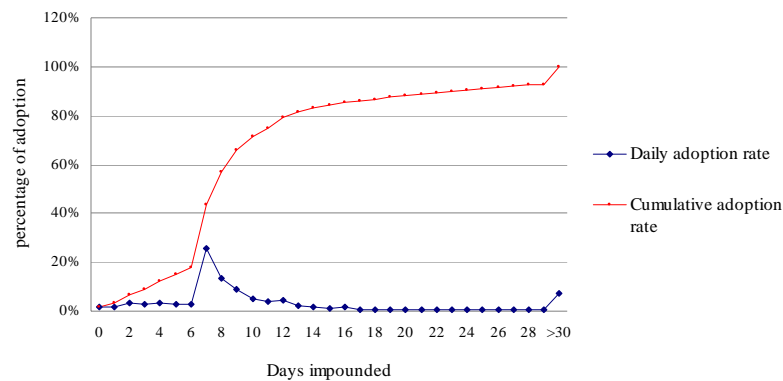
**Statistical Analyses:** The nonparametric Kruskal-Wallis Test was used in this study, in which the number of impoundment days was divided into three categories: 0-6 days, 7-13 days, and over 13 days. The association between these three lengths and the adoption rate was tested. The results showed that the  $p$ -value of the nonparametric Kruskal-Wallis Test was 0.016 ( $p < 0.05$ ). The tests showed that there was a significant difference in the adoption rate between 7-13 days of impound and other lengths of impoundment, suggesting that the adoption rate of the dogs impounded for 7-13 days was the highest.

As shown in Figure 1, after stray animals were impounded for 7-13 days, there is a significant increase in the slope of the blue curve for the adoption rate. The slope of the red curve for the cumulative adoption rate also significantly increases from Day 7 to Day 14. After Day 14, the curve gradually becomes horizontal, and its slope is also close to zero. Therefore, the highest adoption rate was during the period when the dogs were impounded in shelter for 7-13 days.

**Table 1** The association between number of impoundment days and adoption rate of stray dogs at animal shelters from 2004 to 2010 at Changhua County.

Days impounded when adopted	No. of adopted dogs	% of adopted dogs to total adopted dogs	No. of cumulative adopted dogs	% of cumulative adopted dogs to total adopted dogs
0	30	1.9%	30	1.9%
1	22	1.4%	52	3.3%
2	50	3.2%	102	6.6%
3	41	2.6%	143	9.2%
4	48	3.1%	191	12.3%
5	45	2.9%	236	15.2%
6	41	2.6%	277	17.8%
7*	403	25.9%	680	43.8%
8*	208	13.4%	888	57.2%
9*	138	8.9%	1,026	66.1%
10*	81	5.2%	1,107	71.3%
11*	57	3.7%	1,164	75.0%
12*	68	4.4%	1,232	79.3%
13*	37	2.4%	1,269	81.7%
14	21	1.4%	1,290	83.1%
15	18	1.2%	1,308	84.2%
16	21	1.4%	1,329	85.6%
17	10	0.6%	1,339	86.2%
18	7	0.5%	1,346	86.7%
19	12	0.8%	1,358	87.4%
20	10	0.6%	1,368	88.1%
21	11	0.7%	1,379	88.8%
22	6	0.4%	1,385	89.2%
23	11	0.7%	1,396	89.9%
24	6	0.4%	1,402	90.3%
25	8	0.5%	1,410	90.8%
26	10	0.6%	1,420	91.4%
27	8	0.5%	1,428	92.0%
28	10	0.6%	1,438	92.6%
29	4	0.3%	1,442	92.9%
30~188	111	7.1%	1,553	100.0%
Total	1,553	100.0%		

\*Kruskal-Wallis Test,  $p=0.016$ , suggesting that the adoption rate of 7-13 days impounded dogs was the highest.



**Figure 1** The association between number of impoundment days and adoption rate of stray dogs at animal shelters from 2004 to 2010 at Changhua County

### Discussion

This study collected the information of 1,553 adopted dogs. According to the statistical analyses on these cases, this study found that there was a significant difference ( $p < 0.05$ ) in the adoption rate of the group with 7-13 days of being impounded. The result was consistent with the findings of the studies conducted by Coppinger and Zuccotti (1999) and Marston et al. (2005).

When dogs firstly enter shelters, due the sudden disconnection with the owners and the unfamiliar environment, they are under tremendous psychological pressure (Hennessy et al., 1998). Hennessy et al., (1997) also indicates that the plasma cortisol level of dogs in shelters reaches the highest level during the first three days of impounded period. In the first day, the plasma cortisol level is 2.5 times higher than that of household dogs, then decreases. Having impounded for ten days, the plasma cortisol level of dogs is the same as that of household dogs. The change of plasma cortisol indicates the reason for low adoption rate within 0 to 6 days after dogs are impounded.

Coppinger and Zuccotti (1999) indicated that the chances for dogs to be adopted are reduced after they are impounded for more than two weeks due to the fence effect. The fence effect refers to dogs becoming rapidly aware that disturbing behaviors (especially barking) can attract people's attention. When dogs bark, if shelter managers respond by saying "Be quiet," they will learn that barking can attract people's attention without being punished. However, excessive barking is an abnormal behavior that is unfavorable to being adopted. Moreover, dogs are animals that require social behavior. In human society, the objects with whom they have social interactions are human beings and other dogs. Therefore, in restricted shelters, it is necessary to have animals freely control their surroundings and meet their need for social interaction (Serpell, 1995). After being impounded for more than two weeks, dogs will exhibit abnormal behavior such as barking, owing to the failure to obtain a normal life, which reduces the chances of being adopted (Coppinger and Zuccotti, 1999). Moreover, Marston et al. (2005) found that regardless of the location of the shelter, whether in a

city, suburban or rural area, animals are mainly adopted on Day 5 to Day 15. After Day 15, the chances for dogs to be adopted will significantly decrease. Long-term impoundment in shelters will make dogs feel depressed because their needs for normal social interaction cannot be met. Tuber et al. (1999) found that although dogs do not exhibit any abnormal behavior before they are impounded, they may develop abnormal behavior after they are impounded in shelters. Wells et al. (2002) also found that the behaviors of animals impounded in animal shelters are indeed affected by the number of impoundment days. The boredom of a closed environment causes animals to gradually stop responding to stimuli from the external environment. However, to potential owners, dogs with indifferent attitudes are not attractive. Therefore, their intention to adopt such dogs will be reduced (Wells and Hepper, 1992; Wells and Hepper, 2000). Furthermore, due to the chronic stress caused by long-term impoundment, such dogs will exhibit behavior such as forelimb lifting, excessive barking, stereotyping, manipulation of the environment, self-grooming, and coprophagy (Beerda et al., 1999; Hetts et al., 1992; Hubrecht et al., 1992). They may also exhibit indifference and slow responses, owing to the lack of long-term social interactions.

According to the analyses above, if the animals impounded in animal shelters fail to be claimed or adopted within two weeks, they may forever lose the chance of being adopted. Therefore, 14 days can be regarded as the limit of animal welfare, and long-term impoundment exceeding 14 days can be deemed a violation of the overall community animal welfare. Besides leading to abnormal animal behavior that reduces the chance of being adopted, long-term impoundment also increases the risk of being infected with infectious diseases. Some studies have indicated that the risk of being infected with infectious diseases from cats increases with the length of their stay in shelters (Edinboro et al., 1999). Moreover, several studies have verified that stereotyping may be caused by physical changes, which also reflects animals' negative psychological statuses, such as stress from the environment.

Animals in shelters fail to exhibit natural behavior because they are stuck in an environment where their physical, psychological, and social needs cannot be met. The closed and narrow space impedes them from seeking food, exploring the environment, defending their territory, and exhibiting social behavior such as interacting with other members of the same species. Moreover, animals in shelters may suffer from the pressures caused by losing control of the environment, exposure to strange environments, and the loss of social attachments (Hennessy et al., 1997). The abnormal behavior of animals in shelters, such as barking, reveal that their natural needs cannot be met, causing them to excessively develop other behaviors and continue such meaningless stereotyping such as chasing and biting their tails, repeatedly licking their bodies, repeatedly pacing and jumping off the wall, and biting things (Stephen and Ledger, 2005). In addition to revealing the lack of animal welfare, such behavior also indirectly reduces their chances of being adopted. Some studies have indicated that the abnormal behavior of dogs, such as excessive barking and retreating to the back of the cage, all affect potential owners' intention to adopt them (Wells and Hepper, 2000). As a result, extending the length of stay may cause animals to develop more abnormal behavior and lead to a vicious circle of worsening animal welfare.

The results of the statistical analyses performed in this study showed that Day 7 to Day 13 after impoundment is the critical period for dogs to be adopted. The adoption rate before and after this period of time is extremely low. Therefore, this study provides important data as reference to increase the adoption rate of animals.

### References

- Beerda, B., Schilder, M.B.H., Van Hooff, J., De Vries, H.W. and Mol, J.A. 1999. Chronic stress in dogs subjected to social and spatial restriction. I. Behavioral responses. *Physiol Behav.* 66(2):233-242.
- Berenson, M.L., Levine, D.M. and Krehbiel, T.C. 2009. Kruskal-Wallis rank test and Friedman rank test. In: *Basic Business Statistics*. Pearson Education International: 576-586.
- Coppinger, R. and Zuccotti, J. 1999. Kennel enrichment: Exercise and socialization of dogs. *J Appl Anim Welf Sci.* 2(4): 281.
- Edinboro, C.H., Janowitz, L.K., Guptill-Yoran, L. and Glickman, L.T. 1999. A clinical trial of intranasal and subcutaneous vaccines to prevent upper respiratory infection in cats at an animal shelter. *Feline Pract.* 27: 7-13.
- Hennessy, M.B., Davis, H.N., Williams, M.T., Mellott, C. and Douglas, C.W. 1997. Plasma cortisol levels of dogs at a county animal shelter. *Physiol Behav.* 62(3):485-490.
- Hennessy, M.B., Williams, M.T., Miller, D.D., Douglas, C.W. and Voith, V.L. 1998. Influence of male and female petters on plasma cortisol and behaviour: Can human interaction reduce the stress of dogs in a public animal shelter?. *Appl Anim Behav Sci.* 61(1): 63-77.
- Hetts, S., Derrell Clark, J., Calpin, J.P., Arnold, C.E. and Mateo, J.M. 1992. Influence of housing conditions on beagle behaviour. *Appl Anim Behav Sci.* 34(1-2):137-155.
- Hubrecht, R.C., Serpell, J.A. and Poole, T.B. 1992. Correlates of pen size and housing conditions on the behaviour of kennelled dogs. *Appl Anim Behav Sci.* 34(4):365-383.
- Marston, L.C., Bennett, P.C. and Coleman, G.J. 2005. What happens to shelter dogs? part 2. comparing three Melbourne welfare shelters for nonhuman animals. *J Appl Anim Welf Sci.* 8(1):25-45.
- Serpell, J.A. 1995. *The domestic dog: Its evolution, behavior and interactions with people*. Cambridge, England: Cambridge University Press: 116-130.
- Stephen, J.M. and Ledger, R.A. 2005. An audit of behavioral indicators of poor welfare in kennelled dogs in the United Kingdom. *J Appl Anim Welf Sci.* 8(2):79-96.
- Tuber, D.S., Miller, D.D., Caris, K.A., Halter, R., Linden, F. and Hennessy, M.B. 1999. Dogs in animal shelters: Problems, suggestions, and needed expertise. *Psychol Sci.* 10(5):379-386.
- Wells, D.L., Graham, L. and Hepper, P.G. 2002. The influence of length of time in a rescue shelter on the behaviour of kennelled dogs. *Animal Welfare.* 11(3): 317-325.
- Wells, D.L. and Hepper, P.G. 1992. The behaviour of dogs in a rescue shelter. *Animal Welfare.* 1:171-186.
- Wells, D.L. and Hepper, P. G. 2000. The influence of environmental change on the behaviour of sheltered dogs. *Appl Anim Behav Sci.* 68(2): 151-162.
- Weng, H.Y., Kass, P.H., Hart, L.A. and Chomel, B.B. 2006. Animal protection measures in Taiwan: Taiwanese attitudes toward the animal protection law and animal shelters. *J Appl Anim Welf Sci.* 9(4):315-26.
- Zawistowski, S. and Morris, J. 2004. The evolving animal shelter. In: *Shelter Medicine for Veterinarians and Staff*. L. Miller and S. Zawistowski (eds), Blackwell Publishing Asia.: 3-10.

