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Research Article

Associations of Kennel Management Practices with Morbidity and Mortality of Adult Dogs in Kenya

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ABSTRACT

Kennels provide dogs for security and for companionship; however, management errors can lead to increased susceptibility to infections hence an increase in morbidity and mortality within the populations. A cross-sectional study of 35 kennels was conducted in Nairobi, Kenya to determine the effect management practices have on the occurrence of diseases in kenneled adult dog populations. The management practices examined were hygiene, type of housing, type of beddings, provision of heat, food types, provision of veterinary services, deworming practices, ectoparasite control methods, quarantine and euthanasia protocols and methods for diagnosis of diseases. Food types (P=0.006) and ectoparasite control methods (P=0.008) were found to be the strongest independent management factors for morbidity and mortality of the kenneled adult dog population respectively. These management risk factors should be considered by kennel owners when developing disease management programs for their dogs to easily alleviate avoidable morbidities and mortalities.

Key words: Adult dogs, Management practices, Kennels, Kenya

INTRODUCTION

Dog kennel operators in Kenya have provided dogs that serve as guard dogs and as pets and rely on the kennels for their livelihood. However, management and prevention of diseases in dogs continue to be one of the biggest challenges facing kennels (Dudding, 2009). Regardless of their intended purpose, all kennel dog populations face management errors such as deficient vaccination and parasite control, overcrowding, environmental mismanagement and poor feeding which are due to the nature of human decision making (Maple, 2003; Ottway and Hawkins, 2003). Management errors can lead to increased susceptibility to infections hence an increase in morbidity and mortality within the populations (Lawler, 2006; Crawford, 2008).

The aim of this study was to determine the extent of influence management practices have in the occurrence of diseases in kenneled dog populations. Provision of this information will enable dog kennel owners to develop a standard efficient and effective disease management program for their dogs, alleviate easily avoidable morbidities and mortalities and access professional support.

MATERIALS AND METHODS

Study area

The study was conducted in 35 kennels located in the urban and periurban areas in Nairobi, Kenya (1° 17' 0" S,36° 49' 0" E). The study locations were selected randomly for the study and included: Karen, Kikuyu, Kilimani, Upper, Uthiru, Westlands, Kinoo, Langata, Lavington, Embakasi, Hurlingham, Nairobi Industrial Area, Ngara, Parklands, Limuru, Mbagathi Way and Thika.

Data collection

A structured questionnaire comprising open and close ended questions on husbandry practices and disease preventive measures was completed in one visit for each kennel. The investigator using face-to-face interviews with the kennel owners administered the questionnaire. Kennel level data included the name of kennel owner and the location of the kennel. Information on the breeds kept in the kennel, population of dogs in the kennel and the purpose of kennel (security, commercial, and hobby) was collected. The questionnaire further obtained data on management of the kennels: record keeping, provision of

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veterinary services and the role of the veterinarian in the kennels. The data collected contained the following items: use of veterinary services and the role of the veterinarian in the kennels; the type and the frequency of disease preventive measures employed such as deworming practices (mode of administration) and ectoparasite control methods (dipping, shampooing, and spraying); quarantine and euthanasia protocols and methods for diagnosis of diseases. Data on the type of management practice i.e. type of housing (concrete, metal, wooden); beddings (blankets, mattresses, and sacks), feeding (commercial food, rice and meat) and kennel hygiene were verified by physical inspection of the kennel during the visit.

Data analysis

Descriptive statistics reported as percentage were computed from the questionnaire and descriptive tables were generated. The tests for simple associations between management factors and adult dog morbidity and mortality in the kennels were determined with Chi-square (X^2) analysis. Multivariate logistic regression was conducted for factors that were significant by univariate analysis. This was done by using backward elimination and omitting the factors not significant at P<0.05. All analyses were performed with standard software (SPSS, version 11.5, SPSS Inc, Chicago, IL, USA).

RESULTS

Tables 1-4 show descriptive results for the various husbandry and health management factors. The results of the study showed that majority (51.4%) of the kennels bred the dogs for both security and commercial purposes and 40% (14/35) bred for security purposes only (Table 1). All the 35 kennels vaccinated the adult dogs yearly against distemper, hepatitis, leptospirosis, parainfluenza, parvovirus and rabies (DHLP-R) and dewormed the adult dogs with 88.5% (31/35) deworming every 3 months and 8.6% (3/35) deworming every 6 months (Table 2). Majority of the kennels (82.8%) had a mixture of wood, concrete and metal houses. The other type of buildings were wooden houses (8.6%) metal/steel houses with sandy/glass floors (5.7%) and metal/steel houses with concrete floor (2.9%) (Table 3). Most (71.4%) of the kennels quarantined their dogs while 28.6% (10/35) did not quarantine their dogs. Of the kennels that quarantined, 44% (11/25) quarantined the dogs when ill and 48% (12/25) quarantined the dogs when both ill and new (Table 4).

Table 1: Descriptive statistics of breeding practices in the 35 kennels

Factors		Frequency	Percentage (%)
Breeding reasons	Security	14	40
	Commercial	1	2.9
	Security; Commercial	18	51.4
	Security; Other	1	2.9
	Security; Commercial; Other	1	2.9
Duration of operation	4-6	7	20
	7-9	11	31.4
	More than 9	15	42.9
	Unspecified	2	5.7
Source of original parent stock	Locally	28	80
	Europe	1	2.9
	Locally, South Africa	4	11.4
	Europe, South Africa	1	2.9
	Locally, Europe, South Africa	1	2.9
Breeding methods	Stud	34	97.1
	Artificial insemination	1	2.9
Stud used	None	1	2.9
	Own	9	25.7
	Other	25	71.4

Univariate analysis of the following variables was performed to determine associations with morbidity and mortality of adult dogs: hygiene, type of housing, type of beddings, provision of heat, food types, provision of veterinary services, deworming practices, ectoparasite control methods, quarantine protocol, methods for diagnosis of diseases and euthanasia protocol (Table 5). The significant management factors were food types (P=0.007; P=0.03), hygiene (P<0.01), ectoparasite control methods (P<0.01), quarantine (P<0.01) and euthanasia (P<0.01). Multivariate model was run with only significant management factors and results are as shown in Table 6. Only food type was significantly associated with morbidity (P=0.006) and ectoparasite control methods and food types were significantly associated with mortality (P=0.008; P=0.017).

DISCUSSION

A higher number of the kennels bred dogs for use in security purposes indicating the increasing need for people to feel safe not only in their own homes but in high risk areas such as city centres. Majority (42.9%) of the kennels had been operational for more than 9 years. This was an indication that operating kennels was a sustainable business and possibly a reliable source of income. A higher number of the kennels sourced their parent stock locally with a lesser number their stock from Europe and South Africa though this factor was not significantly associated with adult dog morbidity and mortality as reported earlier in studies by Gill, (2001), Indrebø *et al*., (2007) and Borge *et al*., (2011).

Majority (97.1%) of the kennels used a stud either from within their own stock or from other breeders for mating and only one kennel used artificial insemination (AI). There was no significant association between method of mating and adult morbidity and mortality which was similar to the study findings of Farstad, (1984). However, this was not in agreement with studies by Linde Forsberg, (2005a) and Farstad, (2010) who reported that artificial insemination (AI) prevented the spread of sexually transmitted diseases such as *Brucella canis* or *Herpes virus*. This may possibly be due to the low prevalence of canine reproductive diseases in the study population though a study needs to be carried out to confirm this.

Majority (97.1%) of the kennels kept records of the dogs especially medical and reproduction records as recommended (Hurley, 2004; Villa *et al*., 2008). The information in the medical records included: dates of birth and death, breed, sex, age and medical history. Accurate records and data are essential for monitoring the health of

Table 2: Descriptive statistics of disease preventive management practices in the 35 kennels

Factors		Frequency	Percentage (%)
Keeping of records	Yes	34	97.1
	No	1	2.9
Type of records	Medical	25	73.5
	Medical; Reproduction	7	20.6
	Medical; Reproduction; Other	2	5.9
Professional veterinarian attend to the dogs	Yes	35	100
Veterinarian's visits	Resident	11	31.4
	Clinic	5	14.3
	Need arises	17	48.6
	Clinic; Need arises	2	5.7
Veterinarian's role	Vaccination; Deworming	1	2.9
	Vaccination; Advice; Treatment	7	20
	Vaccination; Treatment	4	11.4
	Vaccination; Deworming; Advice; Treatment	8	22.8
	Vaccinations; Deworming; Advice; Surgeries; Treatment	15	42.9
Vaccination of the dogs	Yes	35	100
Frequency of vaccination	Every year	35	100
Vaccination against	DHLP-R	35	100
Deworming of the dogs	Yes	35	100
Frequency of deworming	Every month	1	2.9
	Every 3 months	31	88.5
	Every 6 months	3	8.6
Mode of administration for deworming	Tablet	33	94.3
	Tablet; Injection	2	5.7
Ectoparasite control on the dogs	Yes	35	100
Ectoparasite control method	Dipping	8	22.8
	Dipping; Shampooing	22	62.9
	Dipping; Shampooing; Spraying	3	8.6
	Dipping; Shampooing, Spraying; Other	2	5.7
Frequency of ectoparasite control	Once a week	22	62.9
	Every two weeks	9	25.7
	Unspecified	4	11.4

Table 3: Descriptive statistics regarding the hygiene, type of housing and feeding practices in the 35 kennels

Factors		Frequency	Percentage (%)
Frequency of washing kennels	Daily	35	100
Method of washing kennels	Soap and water	10	28.6
	Disinfectant	1	2.9
	Soap and water; Disinfectant	5	14.3
	Soap and water; Disinfectant; Bleach	7	20
	Soap and water; Bleach	8	22.8
	Bleach; Plain water	2	5.7
	Soap and water; Disinfectant; Bleach; Plain water	2	5.7
Type of housing	Metal/steel with concrete floor	1	2.9
	Metal/steel with wood and sandy/grass floor	2	5.7
	Mixture of wood, concrete and metal	29	82.8
	All wooden houses	3	8.6
Provision of beddings	Yes	12	34.3
	No	23	65.7
Type of beddings	Blankets	5	41.7
	Wooden blocks	7	58.3
Provision of heat	Yes	13	37.1
	No	22	62.9
Source of heat	Normal electric bulb	12	92.3
	Normal electric bulb; Other	1	7.7
Type of feeds	Commercial	19	54.3
	Commercial; Rice/meat	7	20
	Rice/meat	8	22.8
	Commercial; Rice/meat; formulated foods	1	2.9
Frequency of feeding per day	Once	35	100

the animals and demonstrating the efficient and professional management of the kennel (Villa *et al*., 2008; Bartlett *et al*., 2010). All the kennels sourced the services of a professional veterinarian. However, the owners reported that due to cost cutting measures, the veterinarian's visits were only limited to when there was need. This can be a great challenge as the veterinarian is unable to design effective kennel disease preventive measures that would lead to reductions in adult dog morbidities and mortalities (Lawler, 1995; Coffman, 2009).

Table 4: Descriptive statistics regarding quarantine, diagnosis of diseases and euthanasia protocol in the 35 kennels

Factors		Frequency	Percentage (%)
Quarantine of dogs	Yes	25	71.4
	No	10	28.6
Reason for quarantine	When ill	11	44
	When ill; When new	12	48
	When ill; When new; Other	2	8
Signs noted when dogs are sick (owner)	Loss of appetite; Loss of weight; Dullness	16	45.7
	Loss of appetite; Dullness; Poor coat	10	28.6
	Loss of appetite; Loss of weight; Dullness; Poor coat; Other	9	25.7
Diagnosis of diseases (veterinarians)	Clinical signs only	1	2.9
	Clinical signs; Laboratory analysis of samples	2	5.7
	Clinical signs; Postmortem	16	45.7
	Clinical signs; Laboratory analysis of samples; Postmortem	15	42.8
	Postmortem only	1	2.9
Euthanasia of dogs	Yes	32	91.4
	No	3	8.6
Reason for euthanasia	When old	3	9.3
	When old; When in pain	5	15.6
	When old; When in pain; No treatment	14	43.8
	When old; When in pain; Other	4	12.5
	Unspecified	6	18.8

Table 5: Chi square results for factors associated with adult dog morbidity and mortality

Factors	Morbidity		Mortality	
	Chi square	P value	Chi square	P value
Hygiene	30.76	<0.01	12.11	<0.01
Housing	0.038	0.4219	4.001	0.4241
Beddings	0.073	0.4794	5.228	0.4876
Heat	1.368	0.4653	8.346	0.4807
Food types	10.17	0.007	3.92	0.03
Veterinary services	1.185	0.494	3.181	0.4947
Deworming	1.177	0.4409	0.017	0.4984
Ectoparasite control methods	0.856	<0.01	0.806	<0.01
Quarantine	0.654	<0.01	4.065	<0.01
Methods for diagnosis	0.03	0.4878	0.559	0.4673
Euthanasia	0.489	<0.01	4.137	<0.01

The findings of the study showed that all the kennels vaccinated the adult dogs yearly against the major diseases: distemper, hepatitis, leptospirosis, parainfluenza, parvovirus and rabies (DHLP-R) as recommended (Greene and Schultz, 2006; Peterson, 2008). This indicates that the owners are aware of the importance of vaccination as a disease preventive measure (Fischer *et al*., 2007; Welborn and DeVries, 2011). All the kennels dewormed their dogs with a majority deworming every 3 months as recommended (Miller and Zawistowski, 2013). However, the frequency of deworming dogs varied from monthly, every three months and every six months. The frequency of deworming is dependent on different scenarios such as potential zoonotic risks or housing conditions (Epe, 2009). There was no association between frequency of deworming and adult dog morbidity and mortality. The observation was in agreement with studies by Procter *et al*., (2014) and Ahmed *et al*., (2014) who noted that kenneled dogs had a high prevalence of helminths and that helminthosis can be asymptomatic. An inadequate deworming scheme and use of inappropriate anthelmintics can lead to an increase in transmission and in anthelmintic infections in the dogs (Ouergaaw and Boersema, 1998).

All the kennels controlled ectoparasites with the majority preferring to dip and shampoo the dogs with acaricides once a week. There was significant (P=0.008) association between method used for ectoparasite control and adult dog mortality and this agreed with a study by Davoust *et al.*, (2013) who observed that animals that live in the same endemic areas are at risk of high mortality in the absence of efficient methods for ectoparasite control. Ectoparasites not only cause annoyance and irritation, but also are vectors of many diseases some of which are zoonotic, and an aggressive prevention strategy should be instituted for all kenneled dogs (Jones *et al*., 2004; Bowman, 2009).

A higher number (10/35) of the kennels used soap and water to wash the kennels. There was no significant association between (kennel hygiene) washing of the kennels and adult dog morbidity and mortality. This was not in agreement with studies by Santos, (2010) and Tarafder and Samad, (2010) who reported that poor sanitation increased the risk of infection. Proper cleaning and use of disinfectants reduces transmission of infectious agents to dogs and humans (Weese *et al*., 2002; Curtis, 2004).

With regards to the construction, majority (82.8%) of the houses in the kennels were made of a mixture of wood, metal and steel. This is possibly due to the fact that these materials are readily available, structurally sound and easy to clean (Prescott *et al*., 2004; Bossong, 2014). There was no significant association between housing type and adult dog morbidity and mortality. This was not in agreement with studies by Hubrecht, (2002) and Santos, (2010) who postulated that housing factors such as poor ventilation, presence of cracks and difficult to clean surfaces increased risk of infection.

The findings of this study showed that only a small number (12/35) of the kennels provided beddings and this was not significantly associated with morbidity and mortality as was the provision of heat. This could have been due to the fact that provision of beddings and heat in a kennel is for comfort and does not contribute to transmission of infectious agents among dogs (Cline, 2012).

Table 6: Multivariate logistic regression model for management factors associated with adult dog morbidity and mortality

Factor	Morbidity		Factors	Mortality	
	Odds ratio	P value		Odds ratio	P value
Food types- Commercial (Reference)	0.078	0.006*	Ectoparasite control methods - Dipping (Reference)	0.115	0.008*
			Food types-Commercial (Reference)	2.947	0.017*

***** Significance level at P<0.05.

A higher number (19/35) of the kennels fed the dogs on commercial food which is a balanced diet rich in nutrients required by the dog, palatable and easy to prepare (Baldwin *et al*., 2010; Freeman *et al*., 2011). The dogs were fed once a day as recommended (CDA, 2009). There was significant association between food types and adult dog morbidity (P=0.006) and mortality (P=0.017). This observation was noted earlier by Sato *et al*., (2003) and Laflamme, (2005). Meeting essential nutrient needs in dogs, slows the aging process and reduces the risk for cancer, renal disease, arthritis and immune-mediated diseases in dogs (Baldwin *et al*., 2010; Freeman *et al*., 2011).

The results of this study showed that majority (48%) of the kennels quarantined the dogs especially when ill as recommended (CDC, 2008). Failure to quarantine ill dogs as soon as possible increases the risk of transmission of infectious agents to other dogs (ASV, 2008; CDA, 2009). The diagnosis of diseases in the dogs by veterinarians in the kennels was mostly based on a combination of clinical signs and postmortem findings. There was no significant association between methods for diagnosis of diseases and adult dog morbidity and mortality. This was at variance with findings of Lawler, (2006) who explained that misdiagnosis or non-diagnosis increased susceptibility to infections among the kenneled dogs. A higher number (14/35) of the kennels euthanized their dogs for reasons that included old age, severe pain and cases where there was no available treatment. Passantino *et al*., (2006), Newbury, (2009b) and Santos *et al*., (2013) postulated that euthanasia resulted from diseases commonly associated with advanced age.

Conclusion

From this study, it can be concluded that food types and ectoparasite control methods are the strongest independent management factors for morbidity and mortality of kenneled adult dog population respectively. It is important for dog kennel owners to develop a standard efficient and effective disease management program for their dogs that will help alleviate easily avoidable morbidities and mortalities.

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