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Puppy Morbidity and Mortality among Breeding Kennels in Nairobi, Kenya

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Abstract

Aim

The aim of the study was to determine the prevalence of puppy morbidity and mortality in breeding kennels in Nairobi.

Materials and methods

A total of 35 kennels with 556 puppies were selected at random and a questionnaire administered. The study was carried out between 1st October 2013 and 31st March 2014. Faecal samples were taken to determine the levels of infestation to determine whether there was association with puppy morbidity and mortality.

Results

Among all kennels studied, puppy morbidity was noted to be at an average rate of 34.7% (193/556) while puppy mortality was 21.2% (118/556). The majority of the kennels, 57% (20/35), had puppy deaths with 3% (1/35) of the kennels experiencing puppy mortality in every other litter. There were puppy deaths in 34% (12/35) of the kennels but the puppy mortality was rare while 6% (2/35) reported no puppy mortality. Puppy morbidity was reported in 37.1% (13/35) of the kennels in every litter, 25.7% (9/35) had puppy morbidity in every other litter, 31.4% (11/35) rarely had puppy morbidity, whilst only 5.7% (2/35) reported no morbidity.

Conclusion

It is noted that puppy morbidity and mortality is prevalent in Nairobi (Kenya) at 34.7% and 21.2% respectively. There was no association between the age of the puppy and puppy mortality ($p < 0.140$) but there was positive association between the age of the puppy and puppy morbidity ($p < 0.003$).

Keywords: Age; Litter; Worms; Population; Veterinary

Introduction

The dog to human population ratio is estimated to range from 1:4 - 1:11 [1-3, 33]. The human population of Kenya was estimated to be slightly over 43 million in 2012 [33, 37]. Using the dog human population ratio range of 1:8 – 1:11 [1, 3], Kenya today has an estimated dog population of between 3.6 and 4.8 million.

Dog breeders in Kenya are in the business to produce show, companion or guard dogs with an observed stillbirth rate of about 2.3 %, pre-weaning mortality of 11.4 % and a pre-weaning culling rate of 0.9 % for German shepherd dogs [4].

Dog breeding is a thriving business in major cities in Kenya because pets are now filling a variety of roles in people's lives [5]. Their roles vary from attractive avocation, toys, status symbols by choosing purebreds or specific breeds, identity markers in the simple act of being a pet-lover, utilitarian (assisting the disabled, herding livestock, providing security, or sniffing out bombs and narcotics) to providing companionship [5]. Dogs can also provide many positive psychological

and physical benefits for their owners, as well as an important social support [6].

When a breeder or a pet owner loses an animal, they undergo a disenfranchised grief and the losses are either not publicly mourned, openly acknowledged, or socially supported [7-8, 9].

Early puppy deaths have thus become a very common and frustrating phenomenon at the breeders' kennels, small animal clinics and within many security companies that have breeding stocks as they all experience emotional and financial loss following the death of puppies [10-11]. The loss of a puppy or puppies to any of the above parties is consequently a prelude to a lot of financial loss to the breeder, a work and monetary muddle for the security company and an emotional, plus an economic loss for the family [8 - 9].

Neonatal mortality in puppies range from 12% to 36% in both breeding kennels and breeding colonies. Various maternal, litter and environmental factors influence mortality in neonates with neonatal mortality increasing as the bitch ages. The causes may further be divided into three groups: environmental, genetic, and infectious [12, 32, 34, 36].

A large number of studies about puppy mortality have been conducted in other countries especially in the United States of America and European countries [13 - 17]. However, no studies about causes of puppy morbidity and mortality have been done in Kenya to ascertain the different causes of mortality in canine neonates and puppies. Only one study was carried out on adult dog mortality [18]. The aim of the present work was to determine the prevalence and main causes of puppy morbidity and mortality in breeding kennels in Nairobi.

Material and Methods

Study Area

The study was conducted within Nairobi (Kenya) (1.2833° S, 36.8167° E), and its environs. The study locations were selected randomly for the study and included Embakasi (1° 19' 57.7'' S, 36° 54' 1.3'' E), Hurlingham (1° 17' 27'' S, 36° 47' 29'' E), Karen (1° 18' 42.3'' S, 36° 41' 55'' E), Kikuyu (1° 15' 15.6'' S, 36° 40' 54'' E), Kilimani (1° 17' 2.1'' S, 36° 47' 53.2'' E), Kinoo (1° 15' 9.5'' S, 36° 41' 34.9'' E), Langata (1° 22' 0.7'' S, 36° 43' 41'' E), Lavington (1° 16' 28.3'' S, 36° 46' 45.3'' E), Limuru (1° 6' 24.9'' S, 36° 38' 35.3'' E), Mbagathi Way (1° 18' 31.7'' S, 36° 48' 16.8'' E), Nairobi Industrial Area (1° 18' 22.1'' S, 36° 51' 45.7'' E), Ngara (1° 16' 28.8'' S, 36° 49' 44.6'' E), Parklands (1° 15' 44.1'' S, 36° 49' 1''E), Thika (1° 2' 19.5'' S, 37° 5' 0.2''E), Upper Hill (1° 18' 3.9'' S, 36° 49' 1'' E), Uthiru (1° 16' 18.8'' S, 36° 42' 13.7'' E) and Westlands (1° 16' 5.8'' S, 36° 48' 40'' E).

Study Design

A cross-sectional study was used to collect data from the kennels and included the current management and a one-year retrospective study to collect data on puppy morbidity and mortality.

The study was carried out from 1st October 2013 to 31st March 2014. The purposely selected kennels were the total available kennels within Nairobi and its environs. For puppies to be eligible they had to be between 1 day and 6 months old and they were identified using the breeder's records.

Data collection and sampling

Data was carried out by the use of a questionnaire that was completed at the kennels. Kennel level data included date, name of breeder and the location of the kennel, breed identification, total number of dogs (male and female) and purpose of breeding (guard or pets). Questions were asked on management of the kennels, such as type of housing (concrete, metal or wooden), bedding (blankets, mattresses or gunny sacks), type of biosecurity measures applied (quarantine and disinfection) and type of breeding done (natural or artificial insemination).

Questions on housing were verified during the visits through visual observation. The questions also included vaccination program, general management and hygiene. Type and frequency of disease control measures employed such as vaccination protocol (age at first vaccination and diseases vaccinated against), deworming protocol (age of deworming, deworming product used), ectoparasites control (dipping, spraying or spot on) and the role of the veterinarian in the application of these measures were recorded for each kennel. Records of all the puppy morbidity and mortality cases (infections, accidental, euthanasia, and post-caesarean-section) in the kennels within a period of 3 years (2010-2013) and treatments carried out were collected.

Morbidity and mortality were calculated by comparing the number of sick puppies (n) against the total number of the puppies (N = 556) and by comparing the number of puppies dead against the total number of puppies respectively. Two – by – two tables were used to calculate the Chi square value and the p-value to determine if there is any association between a factor and an outcome [35].

Stool samples from a random number of puppies, 20% of the puppies in every kennel, was taken for analysis to ascertain the type of worms they could be having. Faecal floatation test was used to identify the various parasites i.e. common helminthes and protozoa eggs and cysts. This test distorts giardia cysts rapidly and does not float most fluke and some unusual tapeworm and nematode eggs [19].

Data storage and analysis

Data were collected in manual record sheets that were cross-checked and the information validated. The data were then entered into a computer using Microsoft Excel®

2010 (Microsoft Corporation, USA), coded and restructured where applicable. The digital data files were cleaned for any errors that might have occurred during data entry and they were corrected against the original data forms.

The data were exported to SPSS version 16.0.0 [20] statistical package for analysis from Microsoft Excel® 2010. Descriptive statistics were then computed that included frequencies, means, range and standard deviation. These were used to generate descriptive tables. Management factors were investigated for association with puppy mortality. Additional analyses included cross tabulations, and Chi Square tests.

Results

Puppy morbidity was estimated at 34.7% (193/556) and puppy mortality at 21.2% (118/556). Puppy morbidity was estimated at 37.1% (13/35) while puppy mortality was estimated at 57% (20/35) among the kennels in every litter. However, 25.7% (9/35) of the kennels reported puppy morbidity in every other litter while 3% (1/35) of the kennels experienced puppy mortality in every other litter; 31.4 (11/35) rarely reported morbidity in their kennels while 34% (12/35) seldom had puppy mortality. On the other hand, 5.7% (2/35) of the kennels reported no morbidity and 6% (2/35) of the kennels had no puppy mortality.

Puppy morbidity was mostly prevalent between the ages of 0 and 12 weeks at a rate of 22.1% (123/556) while 12.6% (70/556) occurred above 12 weeks of age giving an average rate of 34.7% (193/556) for the puppy population under this study. About 60% (21/35) of the kennels experienced puppy morbidity within the first 12 weeks of puppyhood (Tables 1 and 2).

Table 1. Age (weeks) and morbidity (%) in kennels under study in Nairobi and environs, 2014.

Age	Total Nº of puppies	Nº of sick puppies	% morbidity	Noº of kennels	% kennels
0 - 6 weeks	123	75	13.5%	12	34.3%
7–12weeks	74	48	8.6%	9	25.7%
> 12 weeks	359	70	12.6%	14	40.0%
Totals	556	193	34.7%	35	100.0%

Puppy mortality was noticed at various times during puppy life with 5.7% (2/35) of the kennels not experiencing any deaths. In 17.1% (6/35) of the kennels, puppy deaths occurred within 24 hours after birth, in 54.3% (19/35) of the kennels, puppy mortality occurred within 24 hours after birth and within 1 to 3 weeks later; 5.7% (2/35) of kennels experienced puppy mortality within 24 hours after whelping and 3 to 6 weeks later; 8.6% (3/35) of the kennels experienced puppy mortality within 24 hours after birth and 6 to 12 weeks later; 2.9% (1/35) of the kennels had puppy mortality within 24 hrs. 3 - 6 weeks, 6 - 12 weeks and 3 - 6 months; 2.9% (1/35) had puppy mortality within 3 - 6 weeks and 2.9% (1/35) had puppy mortality within 6 - 12 weeks after birth and 3 - 6 months later (Table 3). There was no significant association between the age and puppy mortality ($p < 0.180$) but there was an association between the age and puppy morbidity ($p < 0.003$) (Table 4).

Table 2. Puppy morbidity (%) in kennels within Nairobi and environs, 2014.

% Morbidity	Nº. of kennels	Total of puppies	Nº of puppies sick	% kennels
0 - 10%	1	31	3	2.9%
11 - 20%	5	44	7	14.3%
21 - 30%	2	69	17	5.7%
31 - 40%	24	388	155	68.6%
41 - 50%	2	19	8	5.7%
51 - 60%	1	5	3	2.9%
TOTALS	35	556	193	100%

Table 3. Puppy mortality in kennels within Nairobi and environs, 2014.

% Mortality	No. of Kennels	Total No. of Puppies	No. of Puppy Deaths	% No. of Kennels
0 - 10%	4	35	2	11.4%
11 - 20%	14	266	47	40.0%
21 - 30%	12	187	44	34.3%
31 - 40%	4	61	22	11.4%
41 - 50%	1	7	3	2.9%
TOTALS	35	556	118	100.0%

Regarding knowledge on the causes of death, 8.6% (3/35) of the owners did not know the causes of death; 5.7% (2/35) knew the causes of death by clinical signs; 28.6% (10/35) knew the causes of death by post mortem examination and 57.1% (20/35), knew the causes of death by post mortem and clinical signs. There was no significant association between knowledge of causes of mortality by the breeder and puppy mortality ($p < 0.518$) or between knowledge of causes of mortality by the breeder and puppy morbidity ($p < 0.345$).

Table 4. Prevalence of puppy morbidity and mortality in Nairobi and environs, 2014.

Factor	Morbidity		Mortality	
	χ^2	P Value	χ^2	P Value
Worms isolated	58.85	< 0.001	4.441	0.0175
Canine population per kennel	91.48	< 0.001	74.93	< 0.001
Age of puppies	8.64	0.003	1.568	0.140
Age of kennels	6.474	0.007	0.021	0.485
Veterinary services rendered	1.122	0.169	96.2	< 0.001

According to the results, 34.3% (12/35) of the kennels reported that enteritis and most of the diseases caused both morbidity and mortality in puppies. Poor mothering behavior was reported in 51.4% (18/35) of the kennels, bacteria or parasites was reported in 42.9% (15/35), problems at parturition (dystocia) in 42.7% (15/35), resultant failure to thrive in 34.3% (12/35), infection with viruses and maternal factors in 31.4% (11/35), hypothermia in 28.6% (10/35), failure to suckle in 25.7% (9/35), worms in 25.7% (9/35), congenital defects in 20.0% (7/35), trauma in 17.1% (6/35), teething in 11.43% (4/35), diarrhea in 11.4% (4/35), and puppy fading syndrome/weakness in 11.4% (4/35). Other reported causes were stress 8.6% (3/35), lack of milk 8.6% (3/35), vomiting 8.6% (3/35), enteritis 8.6% (3/35), dehydration and hypoxia 5.7% (2/35), infected umbilicus 5.7% (2/35), herpes virus 5.7% (2/35), negligence 5.7% (2/35) and stillbirths 2.9% (1/35),.

The breeders had some perception as to what was causing mortality in their kennels. Their perception included 71.4% (25/35) of the kennels considering enteritis as a cause of puppy mortality, 48.57% (17/35) considered worms, 22.9% (8/35) believed in diarrhea as a cause of neonatal death, 14.3% (5/35) were concerned of vomiting, 11.4% (4/35) were apprehensive about bad mothering ability, 11.4% (4/35) were anxious about cannibalism, 8.6% (3/35) feared hypothermia, 8.6% (3/35) dreaded puppy teething, 5.7% (2/35) thought of fading puppy syndrome, 5.7% (2/35) supposed lack of milk from the mother, 5.7% (2/35) assumed of negligence, 5.7% (2/35) alleged of stress, 5.7% (2/35) suspected puppy weakness 2.9% (1/35) purported of herpes virus, 2.9% (1/35) professed of infected umbilicus, 2.9% (1/35) claimed of misdiagnosis, 2.9% (1/35) affirmed of enteritis, 2.9% (1/35) asserted about poisoning, 2.9% (1/35) stressed about poor hygiene, 2.9% (1/35) averred of robbery, and 2.9% (1/35) maintained that stillbirths were the main causes of neonatal mortality.

A large number of puppies were infested by worms with an average of 44.95% of the puppies sampled being positive (Table 5). The type of worms isolated were mainly hookworms (*Ancylostomum caninum*) and roundworms (*Toxocara canis*). No tapeworms were isolated in this study (Tables 5 and 6).

The study kennels carried out euthanasia for various reasons; 5.7% (2/35) of the kennels did not euthanize their puppies due to religious beliefs. About 94.2% (33/35) of the kennels euthanized their puppies in cases of abnormalities whereas 51.4% (18/35) euthanized their puppies in critical cases. On the other hand, 60.0% of the breeding kennels carried out euthanasia due to lack of treatment whereas 34.2% euthanized their puppies in cases of severe pain (Table 7).

Table 5. Faecal results for the puppies sampled for worms.

Kennel	Puppies	No. of Puppies Sampled (n)	No. of Positive Puppies	% Positive per Kennel
1	9	9	0	0.00%
2	31	31	0	0.00%
3	7	7	1	14.29%
4	12	12	8	66.67%
5	60	27	3	11.11%
6	60	25	0	0.00%
7	11	11	11	100.00%
8	5	5	5	100.00%
9	11	11	8	72.73%
10	7	7	3	42.86%
11	11	11	7	63.64%
12	16	16	11	68.75%
13	17	17	9	52.94%
14	16	16	14	87.50%
15	8	8	8	100.00%
16	6	6	6	100.00%
17	12	12	8	66.67%
18	30	30	5	16.67%
19	17	17	6	35.29%
20	24	24	11	45.83%
21	14	14	3	21.43%
22	30	30	1	3.33%
23	9	9	9	100.00%
24	9	9	9	100.00%
25	8	8	3	37.50%
26	12	12	4	33.33%
27	7	7	1	14.29%
28	11	11	3	27.27%
29	12	12	2	16.67%
30	12	12	3	25.00%
31	15	15	7	46.67%
32	19	19	2	10.53%
33	18	18	11	61.11%
34	5	5	1	20.00%
35	5	5	2	40.00%
			Average %	44.95%

Table 6. Type of worm eggs isolated from puppy faecal samples.

Kennel	Hookworms (*Ancylostomum caninum*)	% Hookworms	Ascarids (*Toxocara canis*)	% Ascarids
001	0	0%	0	0%
002	0	0%	0	0%
003	0	0%	0	0%
004	1000	16%	5200	84%
005	0	0%	400	100%
006	0	0%	0	0%
007	3200	100%	0	0%
008	900	64%	500	36%
009	1300	62%	800	38%
010	400	67%	200	33%
011	700	100%	0	0%
012	900	69%	400	31%
013	1400	100%	0	0%
014	1100	55%	900	45%
015	2100	75%	700	25%
016	1600	76%	500	24%
017	1200	11%	10200	89%
018	0	0%	600	100%
019	600	100%	0	0%
020	1000	14%	6400	86%
021	100	33%	200	67%
022	0	0%	1600	100%
023	900	25%	2700	75%
024	600	40%	900	60%
025	1200	80%	300	20%
026	500	100%	0	0%
027	100	100%	0	0%
028	0	0%	700	100%
029	300	100%	0	0%
030	0	0%	500	100%
031	800	38%	1300	62%
032	100	25%	300	75%
033	5200	27%	14200	73%
034	100	33%	200	67%
035	300	100%	0	0%
TOTALS	27600	36%	49700	64%

Table 7. Causes for carrying out euthanasia in breeding kennels within Nairobi (Kenya).

Reasons for euthanasia	No. of Kennels	% of Kennels
Abnormal puppies	33	94.2%
Critical cases	18	51.4%
Lack of treatment	21	60.0%
Severe pain	12	34.2%

Discussion and Conclusions

Most of the kennels had an average number of about 50 dogs with an average number of breeding bitches of between three and six. Neonatal morbidity and mortality are common and often unavoidable problems within breeding kennels. The study showed that there was no significant association between the ages of puppies in the kennels and puppy mortality but a significant association between the ages of puppies in the kennels and puppy morbidity. This agrees with other studies which have stated that the rate of neonatal diseases excluding stillbirths is highest during the first days of life [21].

The rate of morbidity or mortality in puppies, excluding stillbirths, is highest during the first days of life and varies between 11.9% and 34%. Infectious and non-infectious causes influence morbidity and mortality in neonatal puppies [21]. Factors like hypoxia during birth, in-breeding, genetic or teratogenic defects and malformations, maternal disturbances, vaccination status of the mother; low birth weight, environmental conditions or infectious agents predispose puppies to life-threatening conditions [21]. Infectious diseases, essentially bacterial, are the second most important cause of mortality after losses during parturition [21]. When it came to the age at which puppies died, most of the deaths were happening within the first 2 days postpartum [13].

More than 90% of the perinatal mortality was found at both the individual litter and kennel levels. Efforts to minimize puppy mortality should therefore be targeted first at the management of the individual litter then at the kennel level rather than at the breed level [17]. Common-litter factors were more important than additive genetic factors. Mortality attributable to infection increases significantly with increases in inbreeding. [22].

Regarding the knowledge on causes of death by the breeders, there was no significant association between the breeders' knowledge on causes of death and puppy mortality. This can be explained by the fact that since breeders talk among themselves, they have a perception of what could be causing the deaths in puppies within their kennels but unless they involve a veterinarian to investigate and confirm the diagnosis, most of the time their perceptions are always off the mark [23 - 24]. The breeders are convinced that many conditions contribute to puppy mortality including bad mothering ability, cannibalism, diarrhea, enteritis, fading puppy syndrome, herpes, hypothermia, infected umbilicus, lack of milk from the mother, misdiagnosis, negligence, enteritis, poisoning, poor hygiene, dead by shooting), stillbirths, stress, teething, vomiting, weakness and worms. In cases where puppies have a poor mother, they ingest insufficient colostrum and became susceptible to diarrhea particularly at the time of weaning. These perceived conditions never happened in isolation but always appeared together with one, two or more other conditions [25].

Enteritis, diarrhea, vomiting, puppy fading syndrome/weakness, congenital defects, dystocia, poor mothering behavior, hypothermia, infections, failure to suckle, trauma, lack of milk, infected umbilicus, stillbirths and worms, were reported as the main causes of puppy morbidity and mortality as reported elsewhere [26 - 27].

This study showed that there was a challenge when it came to raising puppies and dogs in general. There was lack of knowledge about how important the age or life stage of the puppy was. An individualized approach to each kennel and each puppy is important in terms of parasite control, vaccinations, biosafety and reproductive health and general husbandry. This means preventive medical approach is now more important than has been given that some of these diseases could be zoonotic [28].

The results of feacal examination in the present study allow explaining that majority of breeders in Nairobi overuse dewormers. The breeders need to be informed about the importance of targeting all worms infesting the dog by either combining dewormers or alternating them [29].

Euthanasia was carried out within the breeding kennels for reasons that included congenital abnormalities, critical cases where there was no available treatment and instances of puppies suffering severe pain. A study to investigate puppy mortality in a cohort of boxer puppies was done in the UK in 1998 and it was reported that congenital abnormalities were a cause of euthanasia [25]. In this study, about 94.2% of the kennels reported that abnormalities in general were a cause for euthanasia. About 94.2% of the kennels euthanized their puppies in cases of abnormalities whereas 60.0% of the breeding kennels carried out euthanasia due to lack of treatment. On the other hand, 51.4% of the kennels euthanized their puppies in critical cases while 34.2% euthanized their puppies in cases of severe pain.

The present study shows that there was a serious constraint in providing proper housing and management of kennels in Nairobi and environs. The breeding kennels did not provide beddings to prevent dogs from pressure wounds and cold surfaces, and vaccination protocols were not adhered to by most

breeding kennels leading to poor control of diseases. Breeders also do not use professional veterinary services adequately leading to losses through poor husbandry. The veterinarians also did not appear to have closer interaction with the breeders due to cost of treatment causing the breeders to look for easy way round. There was lack of willingness by the breeders when it came to the provision of colostrum that is important to neonates before developing their own immunity, and the control of ectoparasites and endoparasites is done inadequately.

The above show that the breeders need to provide appropriate housing and segregation of new and sick animals, and adhere to proper sanitation and disinfection of the kennels. Disease surveillance, isolation and treatment are necessary for successful kennel management. Breeding kennels should be provided with good beddings to reduce puppy mortality through hypothermia. Regular preventive procedures such as vaccination, heath assessment, and stringent vaccination protocols should be adhered to strictly to avert losses through puppy mortality.

Authors' Contributions

The present study is a part of Master degree of Andrew Matole Konde. George Karuoya Gitau designed the study. Andrew Matole Konde did the research under the guidance of George Karuoya Gitau, Japheth Chesire Kiptoon and Daniel Waweru Gakuya. All authors participated in the drafting and revision of the manuscript, read and approved the final manuscript.

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