

EARLY PUPPY SURVIVAL RATE IN KANGAL BREED OF TURKISH SHEPHERD DOGS IN THEIR HOMELAND PROVINCE

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ABSTRACT

The aim of this study was to determine the early survival rate (SR) of Kangal puppies and the effects of some environmental factors on this characteristic. In the study, 1024 live born puppies from 168 Kangal dog litters in Sivas Province between 2003 and 2010 were used. The difference between the average SR of the puppies in the first (77.9%) and the second month (96.1%) was significant ($P < 0.001$). The litter size (small, medium and large) and puppy sex (male and female) had no effects on the SR of the puppies ($P > 0.05$). In the first month, the average SR of the puppies from the young (3 years) (82.7%), the middle-aged (>3 years and <7 years) (76.3%) and the old (>7 years) (65.5%) dams were significantly different ($P < 0.01$). However, in the second month, the average SR of the puppies from the old dams (87.5%) was lower ($P < 0.001$) than those from the young (96.5%) and the middle-aged dams (97.5%). The average SR of the puppies born in cold weather conditions (72.3%) was lower ($P = 0.004$) than those born in moderate weather conditions (81.7%) and warm weather conditions (80.1%). The puppies born at the farms (97.5%) had significantly higher ($P = 0.004$) SR than those born in the villages (93.1%) only in the second month. In conclusion, it is recommended that the factors identified as favorable to puppy survival in this study should be taken into account at the reproductive stage, which is an important step in the breeding of Kangal dogs. This study also emphasizes a need to correct the living conditions of puppies and their dams, especially in villages, in order to improve the reproduction and achieve higher survival rates in this valuable breed.

Key words: Puppy, Survival Rate, Kangal Dogs.

INTRODUCTION

Mankind uses various animal species for many purposes including the production of food, clothing, draught power, companionship, recreation, scientific research and education (Sejian *et al.*, 2011). In order for a living species to continue and to reproduce, fertility and the survival of offspring are necessary (Akçapınar and Özbeyaz, 1999). Production of offspring is understood as the mean number of offspring obtained from male or female animals. Losses may result at various stages of the reproductive process from one or more of the following: age, care and feeding factors, climatic factors such as heat and light, geographical conditions, anatomical defects, epidemic and latent diseases and developmental anomalies (Gündo an and Tekeli, 2004). During the neonatal period, puppies are completely dependent on their mothers. Eye-opening at approximately 13 days of age marks the start of the transition period, which ends when the ear channels open at 18–20 days (Jensen, 2007).

Emergency care in neonatal dogs is difficult, and newborn puppies have different physiological characteristics and needs from those of adult dogs; neonatal death is very common, with an average neonatal mortality of 15% to 25% (Veronesi *et al.*, 2009). There is no universally accepted definition of the length of the canine neonatal period, but it is usually regarded as the

first two to three weeks of life. As a result of extensive research using 224 dog breeds, it has been shown that prenatal mortality in litters is significantly influenced by breed, litter number, litter size and age of the bitch, but not by time of year (Tonnessen *et al.*, 2012). There are limited studies on the development of the immune system and maturation of the lymphoid population within the life of the puppy. According to these studies, it is accepted that the concentration of serum immunoglobulins does not fully reach adult levels until 12 months of age. During the first three months of life, puppies have proportionally different lymphocyte cells from adult dogs. The thymus of the puppy involutes during the first year and there is a progressive decline between 6 and 23 months of age (Day, 2007). The development of the canine immune system has been shown to be quite similar to that of the human (Felsburg, 2002) but, as a general rule, mammalian animals with a long period of gestation have a more mature immune system at birth than species with a short period of gestation (Chappuis, 1998).

While sperm production in male dogs continues throughout the year, Kangal bitches, like other dog breeds, come into oestrus at a certain season of the year at 5–13 month intervals (Alacam, 1990). Although their fertility decreases from the age of 6, bitches remain fertile for life and do not experience menopause (Gönül, 1996).

It had been reported that average litter size of Kangal dogs was 6.20 puppies with a range of 1–12 (O rak, 2009).

The Kangal Dog is recognized by the United Kennel Club in the US, and by the National Kennel Clubs of Australia, New Zealand, South Africa and the United Kingdom. The Kangal dog is a large and strong livestock guardian dog with an awe-inspiring stance and balanced proportions (Özcan *et al.*, 2005). Kangal dogs working as livestock guardians in the US were reported to be able to cope with large predators such as the mountain lion (cougar), grizzly bear, bobcat, wolf and coyote (Taylor, 1996). Livestock guardian dogs reduce predation on US farms and ranches by 60–70% or more. In some cases, reduction of losses has been spectacular (Coppinger *et al.*, 1996). A report by Marker (2005) noted that placement of the Kangal breed of Turkish shepherd dogs on Namibian farms could have very positive effects for local farmers, in terms of the economically beneficial impact of reducing stock losses. Considering that the average production cost of a Kangal puppy is 363 Turkish Liras (approximately 200 USD), as reported by Kaygısız and O rak (2008), it is understandable that puppy losses are very important for farmers.

The survival rate of offspring is an important criterion in determining the economic value of offspring born, which is important for all animal producers (Akçapınar and Özbeyaz, 1999). The influence of genetic heritage on survival rate is low ($h^2 = 0.15$), and the survival of puppies is more significantly affected by environmental conditions. A mortality rate of up to 2% in Kangal dog litters is considered normal (Atasoy and Kanlı, 2004). The Province of Sivas lies 1285 m above sea level and has a Central Anatolian climate with cold, snowy winters and hot, dry summers, and an average annual temperature of 8.7 °C (Akbulut and O rak, 2005).

The present research was made under the climatic conditions of Sivas Province, and recorded the early survival rates of live born puppies of the Kangal breed, with the aim of determining the effects of several factors, such as age of dam, litter size, weather conditions, birth place, puppy sex and age, on the survival rate of the puppies.

MATERIALS AND METHODS

Study area and samples: The research material consisted of 1024 puppies obtained from 168 births by Kangal dogs owned by various farms (official and commercial) and breeders in the central Anatolian city of Sivas and its surrounding villages in seven years during the period from 2003 to 2010.

Care and feeding: No extra care was provided for the dogs, either at the farms or in the villages. In general, dogs in the farms had better kennels without any additional heating, while most of the village dogs had basic shelters, those without specially constructed homes using barns and sheep-folds or whatever shelter they could find, especially during birth and suckling periods.

While dogs kept at farms or owned by successful breeders were fed more systematically, breeders generally fed their dogs on yal, which consists mainly of barley flour. The dogs in the farms and those owned by successful breeders were vaccinated, whereas the vaccination was not usually carried out in villages. However, since all vaccination and antiparasitic drug applications were carried out after the two months of age, during which most of the puppies were sold in that time, so this factor had no effect on the present study. Generally, all of the puppies were weaned at the age of one and a half or two months old.

Data: Births, sickness and death of puppies within the province of Sivas were registered through continuous visits and investigations. The age of the dam, date of whelping, litter size and puppy deaths within the first and second months were separately recorded for every case, on previously prepared forms.

The month of birth of the puppies was classified into three categories: cold (<5°C, from November to March), moderate (5 °C and 15 °C, April, May and October) and warm (>15°C, from June to September) according to long-term records of mean temperatures by month for Sivas (Akbulut and O rak, 2005). According to litter size, all of the puppies were grouped into three categories: small (<5 puppies), medium (5, 6 and 7 puppies) and large (>7 puppies). Age of their dam was classified into three categories: young (3 years), middle-aged (>3 years and <7 years) and old (7 years). In addition, all data was handled separately by gender (male and female) and location (farm and village).

Statistical analysis: In the study, Chi-square Tests were used to analyse and evaluate differences in data for the first and the second month and two-month survival rates, for the factors investigated. SPSS 14.0 (SPSS Inc., Chicago, Illinois, USA) statistical package was used for the statistical calculations. Differences were significant at $P < 0.05$.

RESULTS

The average SR of the 1024 live born puppies in the first and the second months are given in Table 1. The SR of the puppies between the first and the second month was different ($P < 0.001$).

Table 1: Puppy survival rates according to months.

<i>Puppies</i>	<i>Months</i>				<i>P</i>	<i>General (Two Months)</i>	
	<i>First Month</i>		<i>Second Month</i>			<i>n</i>	<i>%</i>
	<i>n</i>	<i>%</i>	<i>N</i>	<i>%</i>			
<i>Alive</i>	798	77.9	767	96.1	0.001	767	74.9
<i>Died</i>	226	22.1	31	3.9		257	25.1
<i>Total</i>	1024	100	798	100		1024	100

Puppy survival rates according to age of dams are given in Table 2. The SR of the puppies from the young (82.7%), the middle aged (76.3%) and the old (65.5%) dams were all different (P=0.001) in the first

month, whereas in the second month, the SR of the puppies from the old dams (87.5%) was significantly lower (P=0.001) than those from the young (96.5%) and the old dams (97.5%).

Table 2: Puppy survival rates according to age of dams.

<i>Period</i>	<i>N</i>	<i>Age of Dams</i>			<i>P</i>
		<i>Young</i>	<i>Middle Age</i>	<i>Old</i>	
		<i>Alive, n (%)</i>	<i>Alive, n (%)</i>	<i>Alive, n (%)</i>	
<i>First Month</i>	1024	372 (82.7) ^a	354 (76.3) ^b	72 (65.5) ^c	0.001
<i>Second Month</i>	798	359 (96.5) ^a	345 (97.5) ^a	63 (87.5) ^b	0.001
<i>Two Months</i>	1024	359 (79.8) ^a	345 (74.4) ^b	63 (57.3) ^c	0.001

a, b and c: Rates have different superscripts in same row differ (P < 0.05).

Puppy survival rates according to the weather conditions are given in Table 3. The puppies born in cold weather conditions had significantly lower (P=0.004) SR (72.3%) than those born in moderate (81.7%) and warm (80.1%) weather conditions in the first month. The weather condition effect for the SR of the puppies were not observed in the second month (P=0.808).

Puppy survival rates according to litter size and puppy sex are given in Table 4 and 5, respectively. Both litter size and puppy sex had no significant effect on the SR of the puppies in the first and the second month (P>0.05).

Table 3: Puppy survival rates according to weather conditions.

<i>Period</i>	<i>N</i>	<i>Weather Conditions</i>			<i>P</i>
		<i>Cold</i>	<i>Moderate</i>	<i>Warm</i>	
		<i>Alive, n (%)</i>	<i>Alive, n (%)</i>	<i>Alive, n (%)</i>	
<i>First Month</i>	1024	266 (72.3) ^a	335 (81.7) ^b	197 (80.1) ^b	0.004
<i>Second Month</i>	798	257 (96.6)	322 (96.1)	188 (95.4)	0.808
<i>Two Months</i>	1024	257 (69.8) ^a	322 (78.5) ^b	188 (76.4) ^b	0.017

a and b: Rates have different superscripts in same row differ (P < 0.05).

Table 4: Puppy survival rates according to litter size.

<i>Period</i>	<i>N</i>	<i>Litter Size</i>			<i>P</i>
		<i>Small</i>	<i>Medium</i>	<i>Large</i>	
		<i>Alive, n (%)</i>	<i>Alive, n (%)</i>	<i>Alive, n (%)</i>	
<i>First Month</i>	1024	84 (73.7)	405 (79.9)	309 (76.7)	0.26
<i>Second Month</i>	798	78 (92.9)	389 (96.0)	300 (97.1)	0.20
<i>Two Months</i>	1024	78 (68.4)	389 (76.7)	300 (74.4)	0.17

Table 5: Puppy survival rates according to puppy sex.

<i>Period</i>	<i>N</i>	<i>Puppy Sex</i>		P
		<i>Male</i>	<i>Bitch</i>	
		Alive, n (%)	Alive, n (%)	
<i>First Month</i>	1024	410 (78.1)	388 (77.8)	0.89
<i>Second Month</i>	798	399 (97.3)	368 (94.8)	0.07
Two Months	1024	399 (76.0)	368 (73.7)	0.40

Puppy survival rate according to the breeding places are given in Table 6. The puppies born at the farms had significantly higher (P=0.004) SR (97.5%) than those

born in the villages (93.1%) in the second month. But similar SR (P=0.590) were observed between the farms and the villages in the first month.

Table 6: Puppy survival rates according to breeding place.

<i>Period</i>	<i>N</i>	<i>Breeding Place</i>		P
		<i>Farms</i>	<i>Villages</i>	
		Alive, n (%)	Alive, n (%)	
<i>First Month</i>	1024	550 (77.5)	248 (79.5)	0.590
<i>Second Month</i>	798	536 (97.5)	231 (93.1)	0.004
Two Months	1024	536 (75.5)	231 (73.6)	0.512

DISCUSSION

The survival rates in the present study indicate that most puppy deaths occur in the first month, indicating that emphasis should be placed on conditions in the first month, during which puppies are weaker. This may be related to greater insufficiency of the thymus and immune system in the puppy before one month of age (Day, 2007). Similarly, it may be explained by the fact that levels of serum immunoglobulins (IgA, IgM and IgG) in puppies reach normal adult levels between 2 and 12 months of age (Felsburg, 2002). These sensitive puppies may be more affected by adverse circumstances such as temperature changes, trauma, illness, etc.

Although serum concentration of IgA continues to increase as the dog grows older, the decrease in the immune response mechanism with ageing is not fully understood, but changes in T-cell function and T-cell subpopulation play an important role. Likewise, ageing may influence the humoral immune response by affecting the number and function of B-cells, either directly or indirectly through an effect on T-cells (HogenEsch *et al.*, 2004). Decreasing puppy survival rates as the age of the dam increases can be related to changing physiological factors in the dam. The similar proportional survival rate in puppies born to young and middle-aged dams can be explained by reduction in the effect of maternal age during second month.

Weather conditions are important, especially for physiological adaptation, part of the capability to provide stability or homeostasis of an organism (Akçapınar and Özbeyaz, 1999). While the differences in survival rate in the second month under different climatic conditions

were not statistically significant, they were significant in the first month. The increasing strength of puppies as they reach two months of age may compensate for the negative effects of the cold weather conditions.

It was observed that the sex and the number of puppies born in a litter had no effect on puppy survival rate. As for the place of birth, differences in the average percentage survival rate between farms and villages were significant for only in the second month. It can be concluded that farm facilities are better than the village environment, and that puppies older than one month are more affected by their environment than by their dam. Even though parent dogs had been immunized on the farms, there was no difference between survival rates of the one month old puppy. It can be explained that parent dogs in villages likely to obtain natural immunity via surviving the disease.

Tepeli and Çetin (2000) obtained the following Kangal puppy survival rates from 139 live births: within 15 days 97.84%; at weaning (45 days) 91.36%; at end of second month 87.05%. Kırmızı (1991) placed Turkish Shepherd Dog puppies into two groups: spring–summer puppies and autumn–winter puppies. He found the survival rates for the 539 spring–summer live birth puppies to be 74.5% within 10 days, and 41.0% at the end of two months. He also found the survival rates for the 327 autumn–winter live birth puppies to be 61.1% within 10 days and 39.1% at the end of two months. At every stage, the difference in survival rates between the two seasonal periods (spring–summer and autumn–winter) favoured the spring–summer period, and he found this to be statistically significant (P<0.001).

In the current study, the survival rates of Kangal dog puppies, the length of study period, number of samples, and region of the study were all important factors. General survival rates of Kangal puppies obtained in the current study were found to be lower than those stated by Tepeli and Çetin (2000) and higher than those stated by Kırmızı (1991). The higher survival rates found by Tepeli and Çetin (2000) might be the result of using a smaller group of dogs. The higher rates in the current study as compared to the study by Kırmızı (1991) might relate, first of all, to the dogs being in their natural environment with the climate and conditions to which they were accustomed, and secondly to their ability to move around freely, the opportunity to choose the most suitable place to give birth, the lack of stress caused by being shut in, and the opportunity to take care of their puppies freely. In addition, it might be attributed to the fact that Kırmızı (1991) used all breeds of Turkish shepherd dogs in his survey.

The current study presents valuable information because of the working area covered, the period of study, and the number of samples. In conclusion, it is recommended that the factors identified as favourable to puppy survival in this study should be taken into account at the reproductive stage, which is an important step in the breeding of Kangal dogs, as in all other animal species. Even though environmental factors do not have a significant effect on litter size in Kangal dogs (O rak, 2009), this study emphasizes a need to correct the living conditions of puppies and their dams, especially in the villages, in order to improve reproduction and achieve higher survival rates in this invaluable breed.

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