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SOME MORPHOLOGICAL CHARACTERISTICS AND GROWTH OF KANGAL TURKISH SHEPHERD PUPPIES UNTIL THE WEANING AGE

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Abstract

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This study was carried out to determine growth and survival characteristics of Kangal Turkish shepherd puppies during suckling period. Body weight, survival ratio and some body measurements of the Kangal Turkish shepherd puppies during this period were examined. In addition, effects of mother's age, litter size and sex of the puppy on these body measurements were investigated. The study was conducted on 38 puppies (12 female, 26 male) born from six Kangal Turkish Shepherd bitches.

The average live weights of the puppies were measured to be 1008 g at the end of the first week and 3871 g at the end of the eighth week. The survival ratio was 100 % at the end of the 8th week. Some body measures of the puppies such as head length, head girth, ear length, chest girth, tail length, body length, shoulder height, rump height, front wrist girth, and back wrist girth were 15.07 cm, 24.61 cm, 7.22 cm, 35.36 cm, 16.27 cm, 27.77 cm, 27.32 cm, 26.31 cm, 7.38 cm and 6.73 cm at the age of weaning (52nd day), respectively.

Chest girth, tail length and shoulder height of the puppies born from 8 years old mothers were found to be higher compared to the puppies born from 1 and 3 years old mothers ($P < 0.001$). The effect of birth type on the body measures at the 38th day was determined to be significant ($P < 0.001$). The highest values were obtained from the mothers with five puppies and the lowest values from the mothers with seven puppies. When the comparison is made in terms of sex, even though the male puppies were larger than the female puppies, the difference was not statistically significant.

Key words: Kangal, puppy, growth and survival ratio

Abbreviations: Head length (HL), Head girth (HG), Ear length (EL), Tail length (TL), Body length (BL), Shoulder height (SH), Chest girth (CG), Rump height (RH), Front wrist girth (FWG), Back wrist girth (BWG)

Introduction

The Kangal Shepherd Dog is raised as a guard dog for the herd in some regions, especially in Kangal, the town of Sivas. In order to preserve and improve this national dog breed, a flock has been generated in the Gemlik Military Veterinary School, Dog Unit. It has been transported and started to be raised in many European countries and USA because of the high protection ability of this breed. The Kangal breeders in foreign countries establish clubs under various names, trade and advertise these dogs (Kocher, 2003; Borg, 1996; Tepeli, 2006).

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A better understanding of growth curves for dog guides may aid in estimating mature weight at a young age, thus allowing earlier breeding and training decisions to be made and increasing genetic change per year (Helmink et al., 2000). Most puppies live together with the mother and their siblings for the first eight weeks of their life. During this period, the puppy starts to develop some of its adult behavior (Scott and Fuller, 1965; Case, 1999). Puppies between the ages of 4 and 16 weeks experience a crucial developmental period whereby exposure to many different people, places, animals and environment will enable them to more readily accept changes in the latter phases of their lives and to be less fearful, defensive and aggressive (Voith and Borchelt, 1996). It is known that the survival ratio heritability of the puppies is around 0.15 and the environmental factors have a significant effect on the survival ratio. These factors are the age of the mother, level of nutrition, birth type, diseases and the temperature of the environment (Willis, 1992).

Scientific studies and systematic breeding recording programs must be carried out in order to determine the standards of this breed. In addition, these programs can help to protect the morphologic and physiologic characteristics by pure breeding and selection. This study has been conducted on the Turkish Kangal shepherd dogs in the Gemlik Military Veterinary School, in order to determine the average live weight increase, survival ratio, some morphological body measures after birth and the environmental factors that affect these measures.

Material and Methods

This study was conducted on Turkish Shepherd puppies raised in Gemlik Military Veterinary School and Training Center. Thirty-eight puppies (12 female, 26 male) born from six bitches were used. Each mother was kept in a separate cage together with its own puppies during the study.

The growth characteristics, survival rate and some morphological breed characteristics of the Kangal Turkish Shepherd puppies from birth to weaning (the period between the 0 and the 52th d) have been investigated. The live weights of the puppies were weighed every week in the morning. The procedure was done by a digital scale, which is sensitive up to ± 10 g, after one week later from the birth. The survival rate was obtained by recording the death of the puppies each week. In order to determine morphological breed characteristics of the puppies, 10 different parts of their bodies were measured. These morphological body measures are head length (HL), head girth (HG), ear length (EL), tail length (TL), body length (BL), shoulder height (SH), chest girth (CG), rump height (RH), front wrist girth (FWG), back wrist girth (BWG). The measurements were recorded every 14 d on the 10th, 24th, 38th and 52nd d. A measurement stick was used to measure shoulder height, rump height and body length; while a measurement band was used to measure chest girth, front and back wrist girth, ear length, tail length, head length and head girth. The body parts taken for morphological breed characteristics were described as below (Ariturk, 1983; Spira, 1992).

Head Length (HL): It is the distance between Crista occipitalis and the end of incisivumun. Head Girth (HG): It is the measure of the circumference of the largest part of right and left arcus zygomaticus. Ear Length (EL): It is the distance between the bottom and top of the ear. Tail Length (TL): It is the distance from the end of the tail to the tail sacrum. Body Length (BL): It is the horizontal distance between the Caput humeri and the tuber ischii. Shoulder Height (SH): It is the vertical distance between the highest point of Cidago and the ground. Chest Girth (CG): It is the measure of the circumference taken right behind the Scapula on the level of processus spinalis of the 13th kosta. Rump Height (RH): It is the distance between the highest point of sacrum and the ground. Front wrist Girth (FWG): It is the measurement of the circumference of the thinnest point of Metacarpus. Back wrist Girth (BWG): It is the measurement of the circumference of the thinnest point of Metatarsus.

The puppies were only fed with their mothers' milk until the 30th day. Following this period, the puppies were fed with concentrated feed (between the 30th and 52th day) in addition to milk. The contents of the concentrated feed were 9% water, 29% crude protein, 3.6% crude fiber, 8% crude ash and 17% crude oil. Each puppy was fed 4 times (morning, noon, evening, night) and

each portion per puppy was 50 g of feed. The amount of feed was increased 10 g each week per puppy. The feed, after grinding, was given to puppies. In order to protect the health of the puppies, internal parasite medication on the 14th day, the second internal parasite medication on the 28th day, and the third internal parasite medication on the 42nd day were applied. In addition to the PC (Parva viral-Corona viral) vaccination on the 45th day, and the fourth internal parasite medication on the 50th d were applied.

Statistical analysis

Statistical analyses were used to determine the influences of maternal age, birth type and sex on body measurements. The effects of maternal age, birth type and sex were taken into consideration. The changes in the body measures over time were analyzed by repeated measures analysis of variance (ANOVA), using the generalized linear model (GLM) procedure. The Tukey test was used as simultaneous test procedure in pair wise post hoc comparisons. All statistical analyses were carried out with JMP version 5.1 statistical software (SAS, 2001).

Results and Discussion

The progress in the live weights of the puppies during the study is presented in Figure 1. The live weight observed on the Turkish shepherd puppies in this study were 1008.7 g at the end of the first week, 2025.8 g at the end of the 4th week and 3871 g at the end of the 8th week. The highest increase in the live weight was observed between the 1st and the 2nd week with a value of 442 g. No difference was observed between the live weights of the male and female puppies.

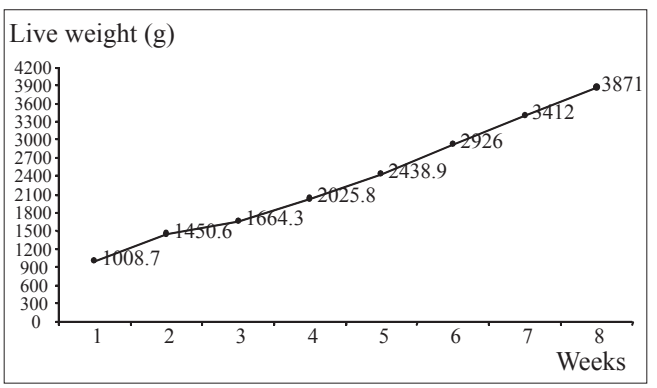

Fig. 1. Mean live weights (g) of Kangal Turkish shepherd puppies until weaning age

The increase in the live weight of the puppies at the end of the (8th week) weaning period was measured to be 3.87 kg. Kirmizi (1991) and Gonul (1996) have stated that the live weight increase of the puppies at the end of the 8th week was 5.45 kg and 5.7 kg in their studies carried out at the same center with the Turkish Kangal shepherd puppies. In different two studies (Tepeli and Cetin, 2000), average live weight of the Turkish Kangal shepherd puppies were recorded as 6.01 kg and 8.91 at the end of two months. The findings of this study are lower than the values stated in the literature. The reason might be the increase in the blood relation level of the population of the Turkish Kangal shepherd puppies raised in the same center.

The birth weights of the puppies have not been recorded in this study. However, the live weight increase at the end of the 1st week was 1008 g in this study. This value is almost the double of the values obtained by Kirmizi (1991) and Gonul (1996) who have stated that the birth weights of the Turkish Kangal shepherd puppies were 535.15 g and 545.72 g in the study carried out in the same center. There is no difference among the birth weights of male and female puppies and this result can be explained by the fact that the Kangal Turkish shepherd bitches take very good care of all its puppies regardless of their sex.

The survival ratio of the Kangal Turkish shepherd puppies was 100% at the end of weaning period (Table 1). The survival ratio of the Kangal Turkish shepherd puppies with the value of 100 % on the 52nd day

Table 1
Survival rates of puppies until weaning age, %

Period	n	%
1 – 7 day	38	100
8 – 14 day	38	100
15 – 21 day	38	100
22 – 28 day	38	100
29 – 35 day	38	100
36 – 42 day	38	100
43 – 52 day	38	100

is higher than the survival ratio of the 2 months old Kangal Turkish shepherd puppies, 87.5%, measured by Tepeli et al. (2003). Karakas et al. (2002) reported that the survival rate of Doberman and Labrador puppies at the end of the 3rd month are respectively 45.56% and 64.57%. This improvement at the survival rate of the Kangal Turkish shepherd puppies raised in Gemlik Centre might be as a result of keeping the shelter and breeding conditions at the optimum level (30-35°C, 55-60% humidity, wood boxes etc.), maintaining the circulation of the air in the shelter, providing the routine disinfection of the shelters, necessary parasite applications until the weaning period during the critical survival period, which is 0-2 months.

The investigated morphologic body measures of the puppies are presented in Table 2. The head length, head girth, ear length, chest girth, tail length, body length, shoulder height, rump height, front wrist girth, and back wrist girth values at the end of the suckling period (52nd day) of the puppies were respectively 15.07, 24.61, 7.22, 35.36, 16.27, 27.77, 27.32, 26.31, 7.38 and 6.73 cm.

Not many studies have been conducted on the morphological characteristics of the Kangal Turkish shepherd puppies in the literature. Thus, comparing the results of this study with the previous findings is not possible. Tepeli and Cetin (2000) stated that the shoulder height, rump height, body height, chest girth, tail length, head length, head girth and ear length of the Turkish Kangal shepherd puppies at the end of the 3rd month were respectively 38.78 cm, 39.99 cm, 33.94 cm, 42.95 cm, 25.85 cm, 17.02 cm, 27.04 cm and 9.05 cm. In this study, the shoulder height, rump height, body length, chest girth, tail length, head length and ear length of the puppies at the end of the suckling period (52nd day) are respectively 27.32 cm, 26.31 cm, 27.77 cm, 35.36 cm, 16.27 cm, 15.07 cm, 24.61 cm and 7.22 cm.

The effect of the age of the mother in terms of the environmental factors on the morphologic body measures is given in Table 3. It has been determined that the effect of the age of the mother on the morphologic body measures is significant. Increase in the morphologic body measures of the puppies have been observed because of the increase at the age of the mother. The body measures of the puppies born especially from the mothers at the age of 8 were higher at the 38th and 52nd day compared to the puppies born from the mothers at the age of 1 and 3 ($P < 0.001$). Only the effect of the age of the mother on the investigated body measures was found to be insignificant ($P > 0.05$).

The effect of birth type (litter size) on the investigated body measures is presented in Table 4. The effect of the birth type on the body measures of the puppies is found to be significant. Tail length, shoulder height, front wrist girth and back wrist girth of the puppies is higher at the birth type with 5 puppies ($P < 0.001$). The difference among the birth types has increased at every stage as the investigated body measures developed.

In this study, the effect of environmental factors such as the age of the mother and birth type on the mor-

Table 2
Some body measurements of Kangal Turkish Shepherd Puppies

Measurements	10 th Day		24 th Day		38 th Day		52 th Day	
	n	Mean ± SE	n	Mean ± SE	n	Mean ± SE	n	Mean ± SE
Head Length	38	10.90 ± 0.10	38	13.18 ± 0.10	38	14.44 ± 0.24	38	15.07 ± 0.39
Head Girth	38	20.21 ± 0.15	38	22.29 ± 0.31	38	23.90 ± 0.28	38	24.61 ± 0.42
Ear Length	38	3.45 ± 0.06	38	4.74 ± 0.05	38	6.18 ± 0.08	38	7.22 ± 0.14
Chest Girth	38	25.13 ± 0.28	38	27.90 ± 0.34	38	31.61 ± 0.36	38	35.36 ± 0.51
Tail Length	38	11.32 ± 0.13	38	13.24 ± 0.23	38	14.87 ± 0.42	38	16.27 ± 0.48
Body Length	38	17.71 ± 0.25	38	20.55 ± 0.09	38	24.63 ± 0.38	38	27.77 ± 0.55
Shoulder Height	38	15.63 ± 0.20	38	19.11 ± 0.25	38	23.50 ± 0.26	38	27.32 ± 0.39
Rump Height	38	14.89 ± 0.20	38	18.13 ± 0.17	38	22.73 ± 0.30	38	26.31 ± 0.46
Front wrist girth	38	6.04 ± 0.09	38	6.42 ± 0.07	38	6.95 ± 0.10	38	7.38 ± 0.12
Back wrist girth	38	5.27 ± 0.07	38	5.82 ± 0.06	38	6.34 ± 0.08	38	6.73 ± 0.10

Table 3
Effects of mother's age on body measurements of Kangal Turkish Shepherd Puppies

Variable	10 th Day			24 th Day			38 th Day			52 th Day		
	Mother age	n	Mean±SE	Mother age	n	Mean±SE	Mother age	n	Mean±SE	Mother age	n	Mean±SE
HL	1	14	10.85^{b} ± 0.09	1	14	12.85 ± 0.09	1	14	12.9^{b} ± 0.34	1	14	12.92^{b} ± 0.34
	3	14	10.42^{b} ± 0.08	3	14	13.35 ± 0.21	3	14	15.0^{a} ± 0.14	3	14	16.28^{a} ± 0.43
	8	10	11.60^{a} ± 0.19	8	10	13.40 ± 0.19	8	10	15.8^{a} ± 0.27	8	10	16.30^{a} ± 0.53
	P		***			-			***			***
HG	1	14	20.92^{a} ± 0.11	1	14	22.71 ± 0.12	1	14	22.42^{b} ± 0.21	1	14	22.43^{b} ± 0.21
	3	14	19.28^{b} ± 0.16	3	14	22.42 ± 0.13	3	14	24.28^{a} ± 0.45	3	14	25.71^{a} ± 0.50
	8	10	20.50^{a} ± 0.25	8	10	21.50 ± 1.15	8	10	25.40^{a} ± 0.38	8	10	26.40^{a} ± 0.78
	P		***			-			***			***
EL	1	14	3.35^{b} ± 0.09	1	14	4.71 ± 0.12	1	14	6.00^{b} ± 0.07	1	14	6.00^{c} ± 0.07
	3	14	3.28^{b} ± 0.06	3	14	4.71 ± 0.06	3	14	6.07^{b} ± 0.17	3	14	6.78^{b} ± 0.19
	8	10	3.80^{a} ± 0.08	8	10	4.80 ± 0.08	8	10	6.60^{a} ± 0.12	8	10	8.20^{a} ± 0.22
	P		***			-			**			***
CG	1	14	23.78^{c} ± 0.29	1	14	26.57^{b} ± 0.44	1	14	30.64^{b} ± 0.32	1	14	30.64^{c} ± 0.32
	3	14	24.85^{b} ± 0.29	3	14	28.50^{a} ± 0.25	3	14	31.00^{b} ± 0.69	3	14	35.07^{b} ± 1.02
	8	10	27.40^{a} ± 0.28	8	10	28.90^{a} ± 0.93	8	10	33.80^{a} ± 0.37	8	10	38.20^{a} ± 0.64
	P		***			**			***			***
TL	1	14	11.14^{b} ± 0.17	1	14	12.00^{c} ±0.25	1	14	13.57^{b} ± 0.17	1	14	13.57^{b} ± 0.17
	3	14	10.85^{b} ± 0.12	3	14	13.14^{b} ±0.16	3	14	13.28^{b} ± 0.24	3	14	14.71^{b} ± 0.35
	8	10	12.20^{a} ± 0.24	8	10	15.10^{a} ±0.22	8	10	18.90^{a} ± 0.34	8	10	20.60^{a} ± 0.66
	P		***			***			***			***
BL	1	14	17.28 ± 0.24	1	14	20.42 ± 0.13	1	14	26.57^{a} ± 0.40	1	14	26.57 ± 0.40
	3	14	17.64 ± 0.41	3	14	20.57 ± 0.13	3	14	22.14^{b} ± 0.17	3	14	25.57 ± 0.66
	8	10	18.40 ± 0.66	8	10	20.70 ± 0.24	8	10	25.40^{a} ± 0.49	8	10	26.20 ± 0.49
	P		-			-			***			-
SH	1	14	15.71^{ab} ± 0.12	1	14	18.00^{b} ± 0.25	1	14	23.28^{b} ± 0.35	1	14	23.28^{c} ± 0.35
	3	14	14.64^{b} ± 0.20	3	14	19.00^{b} ± 0.19	3	14	22.42^{b} ± 0.32	3	14	26.00^{b} ± 0.57
	8	10	16.90^{a} ± 0.42	8	10	20.80^{a} ± 0.53	8	10	25.30^{a} ± 0.34	8	10	29.40^{a} ± 0.61
	P		***			***			***			***
RH	1	14	14.85^{b} ± 0.16	1	14	18.00 ± 0.33	1	14	22.85^{ab} ± 0.53	1	14	22.85^{c} ± 0.53
	3	14	13.85^{c} ± 0.24	3	14	18.07 ± 0.20	3	14	21.50^{b} ± 0.34	3	14	24.78^{b} ± 0.61
	8	10	16.40^{a} ± 0.30	8	10	18.40 ± 0.40	8	10	24.30^{a} ± 0.37	8	10	28.30^{a} ± 0.61
	P		***			-			**			***
FWG	1	14	6.07^{b} ± 0.04	1	14	6.28 ± 0.10	1	14	6.92^{b} ± 0.04	1	14	6.92^{a} ± 0.04
	3	14	5.50^{c} ± 0.00	3	14	6.35 ± 0.09	3	14	6.50^{c} ± 0.18	3	14	7.00^{c} ± 0.27
	8	10	6.76^{a} ± 0.16	8	10	6.70 ± 0.17	8	10	7.60^{a} ± 0.12	8	10	7.90^{a} ± 0.12
	P		***			-			***			***
BWG	1	14	5.42^{b} ± 0.04	1	14	5.71^{b} ± 0.10	1	14	6.35^{ab} ± 0.06	1	14	6.35^{b} ± 0.06
	3	14	4.78^{c} ± 0.06	3	14	5.71^{b} ± 0.06	3	14	6.07^{b} ± 0.17	3	14	6.42^{b} ± 0.25
	8	10	5.74^{a} ± 0.10	8	10	6.12^{a} ± 0.15	8	10	6.70^{a} ± 0.08	8	10	7.00^{a} ± 0.10
	P		***			*			***			*

a,b,c: Means within a column and class not followed by the same letter is different
- : P > 0.05, *: P < 0.05 , **: P < 0.01 , ***: P < 0.001).
HL: head length, HC: head girth, EL: ear length, CC: chest girth, TL: tail length, BL: body length, SH: shoulder height, RH: rump height, FBC: front wrist girth, BBC: back wrist girth

Table 4
Effects of litter size on body measurements of Kangal Turkish Shepherd Puppies

Variable	10 th Day			24 th Day			38 th Day			52 th Day		
	Litter	n	Mean±SE	Litter	n	Mean±SE	Litter	n	Mean±SE	Litter	n	Mean±SE
HL	5	10	11.60 ± 0.19	5	10	13.10 ± 0.19	5	10	15.80 ± 0.27	5	10	16.30 ± 0.53
	7	28	10.64 ± 0.07	7	28	13.40 ± 0.12	7	28	13.90 ± 0.27	7	28	14.60 ± 0.42
	P		***			-			***			*
HG	5	10	20.50 ± 0.25	5	10	21.50 ± 1.15	5	10	25.40 ± 0.38	5	10	26.40 ± 0.78
	7	28	20.10 ± 0.18	7	28	22.57 ± 0.09	7	28	23.35 ± 0.30	7	28	24.07 ± 0.41
	P		-			-			***			***
EL	5	10	3.80 ± 0.08	5	10	4.80 ± 0.08	5	10	6.60 ± 0.12	5	10	8.20 ± 0.22
	7	28	3.32 ± 0.05	7	28	4.71 ± 0.07	7	28	6.03 ± 0.09	7	28	6.39 ± 0.12
	P		***			-			***			***
CG	5	10	27.40 ± 0.28	5	10	28.90 ± 0.93	5	10	33.80 ± 0.37	5	10	38.20 ± 0.64
	7	28	24.32 ± 0.22	7	28	27.53 ± 0.31	7	28	30.82 ± 0.37	7	28	32.85 ± 0.67
	P		***			-			***			***
TL	5	10	12.20 ± 0.24	5	10	15.10 ± 0.22	5	10	18.90 ± 0.34	5	10	20.60 ± 0.66
	7	28	11.00 ± 0.10	7	28	12.57 ± 0.18	7	28	13.42 ± 0.14	7	28	14.14 ± 0.22
	P		***			***			***			***
BL	5	10	18.40 ± 0.66	5	10	20.70 ± 0.24	5	10	25.40 ± 0.49	5	10	26.20 ± 0.49
	7	28	17.46 ± 0.23	7	28	20.50 ± 0.09	7	28	24.35 ± 0.47	7	28	26.07 ± 0.39
	P		-			-			-			-
SH	5	10	16.90 ± 0.42	5	10	20.80 ± 0.53	5	10	25.30 ± 0.34	5	10	29.40 ± 0.61
	7	28	15.17 ± 0.15	7	28	18.50 ± 0.18	7	28	22.85 ± 0.25	7	28	24.64 ± 0.42
	P		***			***			***			***
RH	5	10	16.40 ± 0.30	5	10	18.40 ± 0.40	5	10	24.30 ± 0.37	5	10	28.30 ± 0.61
	7	28	14.35 ± 0.17	7	28	18.03 ± 0.19	7	28	22.17 ± 0.33	7	28	23.82 ± 0.44
	P		***			-			***			***
FWG	5	10	6.76 ± 0.16	5	10	6.70 ± 0.17	5	10	7.60 ± 0.12	5	10	7.90 ± 0.12
	7	28	5.78 ± 0.05	7	28	6.32 ± 0.06	7	28	6.71 ± 0.10	7	28	6.96 ± 0.13
	P		***			*			***			***
BWG	5	10	5.74 ± 0.10	5	10	6.12 ± 0.15	5	10	6.70 ± 0.08	5	10	7.00 ± 0.10
	7	28	5.10 ± 0.07	7	28	5.71 ± 0.05	7	28	6.21 ± 0.09	7	28	6.39 ± 0.12
	P		***			***			***			*

- : $P > 0.05$, *: $P < 0.05$, **: $P < 0.01$, ***: $P < 0.001$
HL: head length, HG: head girth, EL: ear length, CG: chest girth, TL: tail length, BL: body length, SH: shoulder height, RH: rump height, FBG: front wrist girth, BBG: back wrist girth

phologic characteristics of the puppies have been found statistically significant at various levels of significance. Tepeli and Cetin (2000) have observed the highest value of live weight and morphologic body measures at the puppies born from older mothers. The puppies born from older mothers have higher morphologic body measure values probably because of the more developed maternal instincts of the older mothers. The difference can also be resulted from older mothers have smaller litter size than the others in the study. In addition to the effect of sex, which is one of the investigated environmental factors, is statistically insignificant.

Wilson and Sundgren (1998) reported that as the number of the German Shepherd puppies increase, the body measures and the live weights decrease. In this study it has been found out that the birth type with 5

puppies have higher values of live weight and morphologic body measures compared to the birth type with 7 puppies.

Conclusions

As a result, this study is important since it presents the live weight, survival ratio, some morphological characteristics of the Turkish Kangal shepherd puppies and the environmental factors that affect these characteristics. It is beneficial to investigate the relation between the live weight and morphological characteristics of the puppies and their performance during the adult period with future studies. Corresponding study gave some special information's about the breed characteristics of the Kangal Turkish shepherd puppies raised in the Gemlik Military Veterinary School.

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