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## **Some Morphological Characteristics of Kangal Shepherd Dogs (Karabas) Raised at Villages by Farmers in Kirikkale Province**

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### **ABSTRACT**

This study was carried out to determine some morphological characteristics of Kangal (Karabash) dogs raised by private breeders and in civil farms in countryside. Data were collected from Kirikkale province in Middle Anatolia region of Turkey. Total 50 Kangal dogs, 38 male and 12 female were examined. Data were analyzed for sex and age groups. The Duncan test was used for detecting different among groups. This study is the first study about Kangal dogs bred by shepherds at villages and rural areas. Means of the Wither Height (WH), Chest Circumference (CC), the Rump Height (RH), the Rump Length (RL), the Rump Width (RW), Body Length (BL), Chest Depth (CD), Chest Length (CL), the Front Wrist Circumference (FWC), Head Legth (HL), Head Circumference (HC), the Ear Length (EL), Distance Between Ears (DBE), Breadth of Front Chest (BFC), Body Weight (BW), Body Index (the proportion of body length and wither height) (BI), Bone Index (BI2) for Kangal (Karabash) dogs were found 75.91±0.97, 86.12±1.53, 75.92±0.99, 21.85±0.75, 19.44±0.69, 74.77±0.93, 37.62±0.81, 34.43±0.82, 16.57±0.40, 29.09±0.47, 58.14±0.96, 14.32±0.42, 19.04±0.52 and 22.41±0.73 cm, 50.77±2.05 kg, 1.20±0.03, and 0.22±0.01. Effects of sex of dog on WH, RH and HC were statistically significant ( $p < 0.001$ - $p < 0.01$ ), effect on sex of dog on BW and CC were statistically significant ( $p < 0.05$ ). There are significant differences between male and female Kangal dogs for the live weight and somebody measurements. Effect of age of dogs on BI was only statistically significant ( $p < 0.005$ ). In conclusion, it can be said that body measurements and body weigh of Kangal dogs reared at Kirikkale province was generally slightly higher than other regions of Turkey.

**Key words:** Turkish shepherd dog, kangal dog, karabas, morphological characteristics, body measurements, body weight, bone index, body index

### **INTRODUCTION**

Kangal (Karabash), Akbas (Akbash) and Kars (Caucasian) dogs are specific Turkish livestock-guarding breeds gathered under the general rubric of Turkish shepherd dogs (Nelson, 1996; Kirmizibayrak, 2004). Kangal and Akbash dogs are different from each other might have descended maternally from different origins along the evolutionary of domestic dogs (Koban *et al.*, 2009). A lot of studies show that Kangal dogs are genetically distinct and hence they are identified as a breed (Altunok *et al.*, 2005; Gokcek, 2005). Although, Kangal dogs are genetically closer to Scandinavian and South West Asian dogs, Akbash dogs are more similar to European and East Asian dogs, based on the mtDNA control region sequences (Gokcek, 2005).

Kangal dog is recognized and known by different names in different regions of the world. For example, anatolian karabash dog, anatolian shepherd dog, karabash and kangal (Anonymous, 2011). When it is mentioned Turkish shepherd dog, 3 dogs breed are understood (Akbas, Kangal and Kars dog). Karabash means blackhead in Turkish literal meaning and is a special name given to dogs by the Turkish public, is not a dog breed name. The using of name Kangal dogs (Turkish literal mean: coil) is more accurate name for this dog; because of has a queue in the form of coils. Moreover, it is believed that like kangal sheep and kangal dogs were also brought to Anatolia by kangli/kangars which is a Turkish tribe and a branch of Turks, during the great Turkish immigrations to Anatolia. These people bred sheep to meet their need of food during the immigrations which took years to Turkey from Asia and bred the dogs to protect their sheep. Both the sheep and the dogs took their name from the place named Kangal given by the kangli/kangar Turks (Karadag, 2003; Yilmaz, 2007b).

Kangal dog is herd guarding dogs which usually do not herd sheep, like to work independent of the shepherd and which try to avoid the disturbing behaviors like barking, chasing and biting (Ozcan, 2003). According to the shepherds, in case of danger, turning around the sheep flock, kangal dog protects flock against the dangers. Kangal dog was the most successful livestock guarding dog breeds in the United States Department of Agriculture Livestock guarding dog project (Rigg, 2001). Kangal dog was known one of the biggest dogs in the world. It is courageous and agile (Ozcan *et al.*, 2005).

The kangal dog is a speedy runs into a wolf and uses its shoulders and chest to knock it off balance sideways. Sometimes, the back of a wolf is broken when the kangal knocks it. During the attack the kangal dog generally recovers firstly and taking the wolf by the throat kills it. The wolf may wound the kangal dog during this fight. While it fights for its life wolf may bite or scratch the most sensitive parts of the kangal dog, the throat, genital organs or abdomen and ears if not cropped. If the wolf recovers first from the initial attack, it will prefer to run away. Kangal dogs used in guarding goat and sheep flocks in Turkey are protected from wolf bites using by collars studded with long spikes.

Generally, the shepherds in Turkey give Karabas (black head) as a special name for their dogs. Thus, kangal dog is known and recognized with karabash name in Europe and the United States. Naming of writing names of some country in front of the name of karabash must be abandoned.

Morphological traits of kangal dog which is endemic and specific breed for Anatolia should be known very well. In previous researches, weight of Kangal dogs were reported respectively as 48.24, 55.78, 56.71 and 62.24 kg for body weights at 1, 2, 3 and 4 years of dogs by Atasoy *et al.* (2005). Adult weight of kangal dogs were reported as 47.6 kg for males and 43.5 kg for females by Yilmaz (2007a). Weight of kangal and Akbas dogs at 1 year was reported as 40 kg for males and 38 for females by Tepeli *et al.* (2003). This study was carried out to determine the body weight and some body measurements of kangal dogs raised at villages by farmers in Kirikkale Province.

## **MATERIALS AND METHODS**

Fifty kangal shepherd dogs at different ages and genders raised by farms in villages of Kirikkale province were used in this study. Body weights of dogs were weighted with a sensitive scale with 100 g. As body measurements, Wither Height (WH), Chest Circumference (CC), the Rump Height (RH), the Rump Length (RL), the Rump Width (RW), Body Length (BL), Chest

Depth (CD), Chest Length (CL), the Front Wrist Circumference (FWC), Head Length (HL), Head Circumference (HC), the Ear Length (EL), Distance Between Ears (DBE) and Breadth of Front Chest (BFC) were measured. Body measurements of dog were measured according to the methods used by Tepeli and Cetin (2000), Tepeli *et al.* (2003). Bone indexes and format indexes were calculated according to the formulas given below (Kirmizibayrak, 2004; Yilmaz, 2007a):

$$\text{Body index} = \text{height withers} * 100 / \text{body length}$$

$$\text{Bone index} = \text{wrist circumference} * 100 / \text{height withers}$$

**Statistical analyses:** General linear model was used in order to define the difference within age groups and gender groups. In this study, 4 age groups were formed beginning from 1 year and ending at 4 years old and older. Two sex groups were formed as male and female. Duncan Multiple Comparison testing was also used by using Minitab packet program for determining different between groups (Minitab, 1995).

**RESULTS AND DISCUSSION**

Least square means and standard error means values for some body measurements Wither Height (WH), Chest Circumference (CC), the Rump Height (RH), the Rump Length (RL), the Rump Width (RW), Body Length (BL), Chest Depth (CD), Chest Legth (CL), the Front Wrist Circumference (FWC), Head Length (HL) were presented in Table 1. Least square means and standard error means values for some body measurements Head Circumference (HC), the Ear Length (EL), Distance Between Ears (DBE), Breadth of Front Chest (BFC), Body Weight (BW), body index (the proportion of body length and wither height (BI) and Bone index (BI2) were presented in Table 2.

**Wither Height (HW):** In this study, effect of age on wither height were statistically non-significant. Mean of wither height was 75.91±0.97 and 75.19±1.78 cm at 1 year old. After 1 year of age, it can be said that the end of the growth of the wither height. Wither height for male dog

Table 1: Least square means and standard error means values for somebody measurements and live weight

Factors	N	WH	CC	RH	RL	RW	BL	CD	CL	FWC	HL
<b>Age of dogs</b>											
1	10	75.19±1.78	84.74±2.79	75.43±1.84	22.44±1.39	19.58±1.27	71.86±1.72	37.20±1.49	33.95±1.51	15.89±0.74	28.03±0.87
2	18	76.97±1.45	85.82±2.23	75.49±1.49	21.40±1.13	17.22±1.03	76.78±1.40	36.19±1.21	33.76±1.23	17.12±0.60	28.83±0.71
3	8	76.83±2.15	84.59±3.19	78.06±2.22	22.95±1.68	20.75±1.53	75.20±2.08	40.01±1.80	36.11±1.83	16.62±0.89	28.63±1.06
4 and older	14	74.66±1.68	88.20±2.57	74.72±1.74	20.61±1.32	20.21±1.20	75.24±1.63	37.09±1.41	33.91±1.43	16.66±0.70	30.86±0.83
p- value		ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
<b>Sex of dogs</b>											
Female	12	72.86±1.64	82.52±2.57	73.07±1.69	21.06±1.28	19.85±1.17	73.57±1.58	36.64±1.37	34.19±1.39	16.02±0.68	28.22±0.80
Male	38	78.97±0.99	89.16±1.50	78.78±1.03	22.64±0.78	19.03±0.71	75.97±0.97	38.60±0.84	34.67±0.85	17.12±0.41	29.96±0.49
Means	50	75.91±0.97	86.12±1.53	75.92±0.99	21.85±0.75	19.44±0.69	74.77±0.93	37.62±0.81	34.43±0.82	16.57±0.40	29.09±0.47
p- value		0.003**	0.030*	0.006**	ns	ns	ns	ns	ns	ns	ns

Data is as Mean±SD. ns: Non-significant. Values with the different letters show significant difference between years (p<0.01), WH: Wther height, CC: Chest circumference, RH: Rump hight, RL: Rump length, RW: Rump width, BL: Body length, CD: Chest depth, CL: Chest length, FEC: Front wrist circumference, HL: Head length

Table 2: Least square means and standard error means values for some body measurements and live weight

Factor	N (No. of dog)	HC	DBE	BFC	BW	BI	B12	N (No. of dog for EL)	EL
<b>Age of dogs</b>									
1	10	55.71±1.77	18.31±0.95	22.70±1.34	47.41±3.76	1.26±0.05	0.21±0.02	4	14.09±0.91
2	18	58.05±1.44	17.86±0.78	20.79±1.09	50.09±3.06	1.06±0.04	0.24±0.01	5	14.26±0.79
3	8	60.51±2.14	20.41±1.15	22.97±1.62	51.46±4.56	1.22±0.06	0.22±0.02	4	15.00±0.87
4 and older	14	58.29±1.67	19.58±0.90	23.19±1.27	54.12±3.57	1.24±0.05	0.22±0.01	5	13.91±0.93
p-value		ns	ns	ns	ns	* 0.009	ns		ns
<b>Sex of dogs</b>									
Female	12	53.67±1.63	18.32±0.88	21.68±1.23	45.84±3.47	1.19±0.04	0.22±0.01	7	13.63±0.73
Male	38	62.61±0.99	19.76±0.54	23.14±0.75	55.70±2.12	1.21±0.03	0.23±0.01	11	15.00±0.59
Mean	50	58.14±0.96	19.04±0.52	22.41±0.73	50.77±2.05	1.20±0.03	0.22±0.01	18	14.32±0.42
p-value		*** (0.000)	ns	ns	* 0.019	ns	ns		ns

Data is as Mean±SD. ns: Non-significant. Values with the different letters show significant difference between years (p<0.01). HC: Head circumference, EL: Ear length, DBE: Distance between ears, BFC: Breadth of front chest, BW: Body weight, BI: Body index (the proportion of body length and wither height), B12: Bone index

at 1 year old was higher than female dogs as reported previously (Tepeli and Cetin, 2000; Tepeli *et al.*, 2003). Wither height was higher in male kangal dogs than female dogs, as reported previously (Ozbeyaz, 1994; Tepeli and Cetin, 2000; Atasoy *et al.*, 2005; Daskiran, 2007; Yilmaz, 2007a).

In this study, wither height at mature Kangal dogs were found as 75.91±0.97 cm, with according to Atasoy *et al.* (2005) in the Ankara. This value is longer in previously researches for Kangal dog in different regions (Ozbeyaz, 1994; Daskiran, 2007; Yilmaz, 2007a). Further, wither height at mature kangal dogs were higher than other shepherd dog breeds, 66 cm in Akbas dog (Atasoy *et al.*, 2011) and 64 cm in kars dog (Kirmizibayrak, 2004).

**Chest Circumference (CC):** In this study, chest circumference was reported 82.52±2.57 for female and 89.16±1.50 cm for male and between 84.74±2.79 cm at 1 year and 88.20±2.57 cm at 4 years old.

Chest circumference of 1 year old kangal was 84.74±2.79 cm and higher than values between 78.10 and 82.61 at 1 year old (Tepeli and Cetin, 2000; Tepeli *et al.*, 2003; Daskiran, 2007). However, longer of chest circumference value reported by Atasoy *et al.* (2005), it may be associated with better feeding of dogs reared a private farm than dogs reared at villages. Chest circumference of mature kangal dogs was shorter than values reported between 74 cm and 79 cm for female (Ozbeyaz, 1994; Daskiran, 2007) and longer than 93cm value reported by Atasoy *et al.* (2005). Longer chest circumference value reported female and male dogs by Atasoy *et al.* (2005) and similar to Yilmaz (2007a) it may be reason good feeding in farm conditions for dogs of reared private farm in Ankara. To a good sheepdog of a kangal dog, chest circumference is not required to be too long, if chest circumference of kangal dog increase, they are cumbersome and can only be used at protection of home and workplace. Further, chest circumference at mature Kangal dogs were higher than other Turkish shepherd dog breeds, 83.67 cm in Akbas dog (Atasoy *et al.*, 2011) and 71.6 cm in kars dog (Kirmizibayrak, 2004). In all Turkish shepherd dogs (Kangal, Akbas and Kars dogs); chest circumference of male was longer than female (Ozbeyaz, 1994; Tepeli and Cetin, 2000; Tepeli *et al.*, 2003; Kirmizibayrak, 2004; Atasoy *et al.*, 2005; Daskiran, 2007; Yilmaz, 2007a; Atasoy *et al.*, 2011).

**Rump Height (RH):** In this study, rump height was reported  $73.07 \pm 1.69$  for female and  $78.78 \pm 1.03$  cm for male. This value is longer than values between 64 and 73 cm for kangal dogs (Ozbeyaz, 1994; Tepeli and Cetin, 2000; Tepeli *et al.*, 2003; Daskiran, 2007) and for kars shepherd dogs (Kirmizibayrak, 2004). It can be said that rump height of Kangal dogs at Kirikkale region was longer than other regions of Turkey. Effect of sex of dog was statistically significant ( $p < 0.01$ ) and longer rump height in male dogs. Rump height for male dog was longer than females in all age periods, with accordance to Ozbeyaz (1994), Tepeli and Cetin (2000), Daskiran (2007) and Yilmaz (2007a).

**Rump Length (RL):** In this study, rump length was  $21.06 \pm 1.28$  cm for female and  $22.64 \pm 0.78$  cm for male. A study has not been conducted on rump length before. Findings of this study are important because, it indicates the direction to future studies. As expected, rump length in males was larger than females.

**Rump Width (RW):** In this study, rump width was reported  $19.85 \pm 1.17$  cm for female and  $19.03 \pm 0.71$  cm for male and between  $19.58 \pm 1.27$  cm at 1 year and  $20.21 \pm 1.20$  cm at 4 years old.

In this study, rump width was reported 19.85 for female and 19.03 for male, in agreement with different age and sex by Tepeli and Cetin (2000) and Yilmaz (2007a). Rump width of mature kangal dogs was slightly higher than kars dogs (Kirmizibayrak, 2004). Because of the ease birth, it is wanted rump in female animals to be tend and large. Although, there is no statistically significant difference, rump width measure of the female dogs were longer than males. As width of rump give the female feature to make easy birth, width rump of female dog growth with natural mechanism growth as good as male dogs, may be developed like the male animals.

**Body Length (BL):** Body length was between  $71.86 \pm 1.72$  cm at 1 year old and  $75.24 \pm 1.63$  cm at 4 years old,  $73.57 \pm 1.58$  cm for female and  $75.97 \pm 0.97$  cm for males.

Although, effect of sex and age of dogs on body length were non-significant, body length increase with increasing old was shown. Body length of male was longer than female. In this study, body length of kangal dogs at 1 year old was longer than previous researches in Sivas and Konya regions (Tepeli and Cetin, 2000; Daskiran, 2007), similar to in Ankara region (Atasoy *et al.*, 2005) and longer than kars and akbas dogs (Akbash) (Kirmizibayrak, 2004; Atasoy *et al.*, 2005) and was shorter than kangal dogs in various regions of Turkey (Yilmaz, 2007a).

**Chest Depth (CD):** Chest depth was between  $37.20 \pm 1.49$  cm at 1 year old and  $37.09 \pm 1.41$  cm at 4 years old,  $36.64 \pm 1.37$  cm for female and  $38.60 \pm 0.84$  cm for males. In this study, chest depth was longer than previously researches in all Turkish shepherd dogs (Tepeli and Cetin, 2000; Kirmizibayrak, 2004; Yilmaz, 2007a; Atasoy *et al.*, 2011) and nearly similar to Atasoy *et al.* (2005). Chest depth of male was longer than female as reported previously (Tepeli and Cetin, 2000; Kirmizibayrak, 2004; Yilmaz, 2007a; Atasoy *et al.*, 2011).

**Chest Length (CL):** In this study, chest length was  $34.19 \pm 1.39$  cm for female and  $34.67 \pm 0.85$  cm for male. A researcher has been not conducted on chest length of Kangal dogs before. Findings of this study are important because it indicates the direction for future studies. Although, effect of sex of dogs on chest length was non-significant ( $p > 0.05$ ), chest length in males was larger than females as expected.

**Front Wrist Circumference (FWC):** In this study, front wrist circumference reported  $16.02 \pm 0.68$  for female and  $17.12 \pm 0.41$  for male and between  $15.89 \pm 0.74$  cm at 1 year and  $16.66 \pm 0.70$  cm at 4 years old.

Wrist circumference for 1 year and 4 years old were similar to previous research Atasoy *et al.* (2005) and longer than previous researches at different regions in Turkey for kangal (Daskiran, 2007; Yilmaz, 2007a) and other Turkish shepherd dog breeds (Kirmizibayrak, 2004; Atasoy *et al.*, 2011). As expected, wrist circumference of male was longer than female (Daskiran, 2007; Yilmaz, 2007a; Kirmizibayrak, 2004; Atasoy *et al.*, 2011).

**Head Length (HL):** In this study, head length was  $28.03 \pm 0.87$  cm at 1 year old,  $30.86 \pm 0.83$  cm at 4 years and older,  $28.22 \pm 0.80$  cm for female and  $29.96 \pm 0.49$  cm for male.

The mesocephalic head is large but in good proportion with the body in general. The proportion of the foreface to the head length is between 1: 2.1-2.5. While the head of male dog resembles that of a lion, the head of the bitch is comparatively narrower and more elegant. The ears are set well apart and black. Characteristics black mask covers the nose and mouth (Ozcan *et al.*, 2005).

Although effects of age and sex on head length were not statistically significant, it can be said that head length increased with age. In this study, head length was 28 cm at 1 year old was similar to Tepeli and Cetin (2000) and Tepeli and Cetin (2003) and smaller than value reported by Atasoy *et al.* (2005). Head length was 30.86 cm at mature age and smaller than value reported by Atasoy *et al.* (2005), similar to Yilmaz (2007a) and longer than value reported by Ozbeyaz (1994) and Daskiran (2007). Head length of male dog was longer than female as reported by previous researches (Ozbeyaz, 1994; Atasoy *et al.*, 2005; Daskiran, 2007; Tepeli and Cetin, 2000; Tepeli and Cetin, 2003; Yilmaz, 2007a). Head length of mature Kangal dogs were higher than other shepherd dog breeds, 28.75 cm in Akbas dog (Atasoy *et al.*, 2011) and similar to 30 cm in kars dog (Kirmizibayrak, 2004).

**Head Circumference (HC):** In this study, the least squares means were  $55.71 \pm 1.77$ ,  $58.05 \pm 1.44$ ,  $60.51 \pm 2.14$ ,  $58.29 \pm 1.67$  cm for head circumference of 1, 2, 3 and 4 years of dogs and  $53.67 \pm 1.63$  cm for female and  $62.61 \pm 0.99$  cm for male as expected.

Head circumference for Kangal at 1 year old was longer than value reported by Tepeli and Cetin (2000) and similar to value for mature age reported by Yilmaz (2007a). Head circumference of mature kangal dogs was higher than Akbaş dog (Tepeli and Cetin, 2003) and similar to 54 cm in kars dog (Kirmizibayrak, 2004). Such as other body measurements, head circumference of male dogs was higher than females (Tepeli and Cetin, 2000; Kirmizibayrak, 2004; Yilmaz, 2007a).

**Ear Length (EL):** Ear length was reported between  $13.91 \pm 0.93$  cm and  $15.00 \pm 0.87$  cm,  $15.00 \pm 0.59$  cm for male  $13.63 \pm 0.73$  cm for female.

In general, when the shepherd dogs were fight with each other and especially with the wolf, they take injuries seriously, in this case, ear may be cut off in accordance with animal welfare by veterinary medicine. Ear length was a little longer than previous studies (Ozbeyaz, 1994; Daskiran, 2007; Yilmaz, 2007a). Daskiran (2007) reported the ear length was 11.4 cm for male and ear length at female with error measurement was reported as 4 cm. Such as other body measurements, the ear length of male dogs was higher than females as reported previously (Ozbeyaz, 1994; Daskiran, 2007; Yilmaz, 2007a).

**Distance Between Ears (DBE):** In this study, distance between ears was reported between 17.86 cm and 20.41 cm in different ages and 19.76 cm for male dogs and 18.32 cm for female dogs.

In this study, distance between ears was similar to previously research for kangal dogs Atasoy *et al.* (2005), however, longer than Akbas dog and Kars dogs (Kirmizibayrak, 2004; Atasoy *et al.*, 2011). Distance between ears of male dogs was higher than females as reported previously (Kirmizibayrak, 2004; Atasoy *et al.*, 2005; Atasoy *et al.*, 2011).

**Breadth of Front Chest (BFC):** In this study, breadth of front chest was reported 21.68±1.23 for female and 23.14±0.75 for male and between 22.70±1.34 cm at 1 year and 23.19±1.27 cm at 4 years old.

Breadth of front chest should be with sufficient size, should be sturdy and strong because of male dog hits wolf with brisket. Tepeli and Cetin (2000) have only been conducted on breadth of front chest before. In this study, breadth of front chest for both male and female was slightly longer than previous research (Tepeli and Cetin, 2000). Breadth of front chest of male dogs was higher than females similar to previous research (Tepeli and Cetin, 2000).

**Body Weight (BW):** In this study, the least squares means for body weights for 1, 2, 3 and 4 years of Kangal dogs were 47.41±3.76, 50.09±3.06, 51.46±4.56, 54.12±3.57 kg, respectively. As expected, body weight increased with increase of age. Mean body weight was 45.84±3.47 kg for female and 55.70±2.12 kg for male dogs. Body weight of male dog was bigger than female dogs like many animal species. Body weight of Kangal dog was reported between 32.4 and 43.5 kg in female (Ozbeyaz, 1994; Tepeli *et al.*, 2003; Daskiran, 2007; Yilmaz, 2007a) and between 40.5 kg and 59.93 in male (Ozbeyaz, 1994; Tepeli *et al.*, 2003; Atasoy *et al.*, 2005; Daskiran, 2007; Yilmaz, 2007a). Atasoy *et al.* (2005) reported body weight of female Kangal dog as 51.56 kg, may be associated with good feeding and breeding of female dogs raised on a private farm which was operated by the shepherd dogs protection association in Ankara.

In this study, body weight was between 47.41 kg at 1 year old and 54.12 kg at 4 years old. Body weight increased slowly with age until 4 years old. Weight at 1 year was higher than some researches in Konya and Sivas regions (Tepeli and Cetin, 2000; Tepeli and Cetin, 2003; Daskiran, 2007) and nearly similar to result of research in Ankara region (Atasoy *et al.*, 2005). Kangal dogs have bigger body weight in Ankara and Kirikkale regions; it may be differences of feeding, climatic and geographic differences and preferring to dogs with larger body by breeder. Body weight of mature kangal dogs was higher than other shepherd dog breeds, 35kg in Akbas dog (Atasoy *et al.*, 2011) and 42 kg in Kars dog (Kirmizibayrak, 2004). Because female dog have light weight, female dogs runs faster than wolf and cuts the way of wolf.

**Body index:** In this study, the least squares means were 1.26±0.05, 1.06±0.04, 1.22±0.06 and 1.24±0.05 kg for body indexes of 1, 2, 3 and 4 years of dogs and 1.19±0.04 for female and 1.21±0.03 for male dogs. Yilmaz (2007a) reported body index of kangal dogs was 0.885±0.43 for male, 0.903±0.52 for female and mean body index is statistically different between male and female ( $p < 0.05$ ). Smaller body index 2 years old dog may be associated with longer body length of 2 years old dog as unique to this study.

**Bone index:** In this study, the least squares means were 0.21±0.02, 0.24±0.01, 0.22±0.02 and 0.22±0.01 for bone index of 1, 2, 3 and 4 years of dogs and 0.22±0.01 for female and 0.23±0.01



for male. Kirmizibayrak (2004) bone index reported  $0.223 \pm 0.30$  for male and  $0.201 \pm 0.37$  cm for female Kars dogs. In this study, Bone index as found 0.22 and similar to previous research (Kirmizibayrak, 2004). Although there are not differences between male and female as statistically, it can be said that bone index for male dog was bigger than female dog; this may be associated with having thicker front wrist circumference of male kangal dog.

## CONCLUSION

All the studies about kangal dogs were done in Turkey as a breed of dog belonging to the Turks. Since 1960's Turkish kangal (Karabash) Shepherd Dogs were taken to numerous countries in the world. Nowadays this dog is bred in five continents (Yilmaz and Ertugrul, 2011), the recognition of other names like karabash is not true. The most outstanding examples of kangal dog are breed in Anatolia because kangal dog is an endemic breed specific to Anatolia which climate is characterized by a continental climate, with hot summers and cold snowy winters. Breed standard of kangal dogs by Turkish standard institution were determined in March 1997 in the Turkey. To protect existence of kangal dogs, to conserve the genetic purity of the kangal Dog and to help to the recognition of kangal Dog worldwide, The federation of dog breeds and cynology, (KIF) and some associations, for example the Turkish Shepherds' Dogs Protection Society in Turkey were formed. It was reported some diseases like Ankyloglossia or frenulum lingue is short and or thick fibrotic (Erisen, 2011) and hip dysplasia were shown rarely been in previous researches (Tepeli, 2003; Yardimci *et al.*, 2008). Kangal dogs do not breed sibling to sibling, dam to son or sire to daughter. They are extremely selective about their breeding. Kangal dogs do not normally mate with any other dog breed even when they are free (Yilmaz, 2007b). Because of these trait, Kangal dog have been bred as purebred for centuries. Today, sometimes, origin of kangal dog has not mentioned knowingly or unknowingly as Turkey. Because of all outstanding features, increasing and widespread of breeding of kangal dog in Turkey, United States and other countries are expected. It should be noted that the kangal dog is never a Turkish shepherd dog. Names like Karabash, American Anatolian and Anatolian dog instead of Kangal should not be used. Instead of karabash, kangal dog name should be used in all around the world. Since centuries, origin of kangal dog has been known as Anatolia region at Turkey. Kangal (Karabas) dogs should be known as a Turkish shepherd dog at all books, websites and cinema films forever. In conclusion, it can be said that body measurements and body weigh of kangal dogs reared at Kirikkale province was generally slightly higher than other regions of Turkey.

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