Phenotypic characterization of Rajapalayam dog of Southern India

K N RAJA[1], P K SINGH[2], A K MISHRA[3], I GANGULY[4], P DEVENDRAN[5] and S KATHIRVEL[6]

ICAR-National Bureau of Animal Genetic Resources, Karnal, Haryana 132 001 India
and
Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu 600 007 India

ABSTRACT

The present study was undertaken for phenotypic characterization of Rajapalayam, an important dog breed of southern India. Rajapalayam dog population originated from Rajapalayam taluk of Virudhunagar district of southern Tamil Nadu. Surveys on Rajapalayam dog were undertaken in Rajapalayam town, villages of Rajapalayam taluk and Dog Breeding Unit at Chennai (Govt. of Tamil Nadu). Sets of questionnaire and breed descriptor formats were developed to collect information on different aspects of phenotypic characterization. During the survey, 26 each of physical and morphometric traits were recorded on 88 adult and 21 puppies. Information on different aspects of management of animals was collected through interview of 20 Rajapalayam dog owners. Rajapalayam dogs were medium in size with compact body, tucked-up abdomen, white coat colour, pink skin, nostrils and eyelids, dropping ears, semi-curved tail and straight top line. The eyes were golden in colour and the nasal bridge was straight. The mean body weight was obtained as 24.69±0.43 and 21.42±0.47 kg for adult male and females, respectively. In bitches, age at first estrus ranged from 12–15 months with duration of estrus as 13 to 21 days after estrus bleeding. The main breeding season was from November to January and gestation length was 2 months. The age at first whelping ranged between 21–27 months with a whelping interval of 8–12 months and number of whelping in lifetime was 10 to 12. The litter size ranged from 4 to 10 and age at weaning was 30–45 days. The dogs were maintained mostly on non-vegetarian food and feeding was done twice in a day, in majority of cases with milk, rice and egg. Breeders used to vaccinate the dogs regularly and deworming was also practiced. Rajapalayam dogs were mainly used for guarding of farm and farm houses. This unique canine germplasm needs to be documented and registered at National level for the benefit of the dog owners, dog breeders and Kennel clubs. The breed can be popularized through dog shows and other forms of documentation.

Key words: Dog, Management, Phenotypic characterization, Rajapalayam

India is known for its domestic animal diversity which is reflected in the form of various breeds and varieties. In the national registration system of diversity of livestock and poultry, a total of 160 breeds belonging to cattle, buffalo, goat, sheep, pig, horse, camel, donkey and poultry were registered, but none of the dog breed was registered so far. Some of the Indian breeds of dog are Caravan Hound, Combai, Chippiparai, Rajapalayam, Rampur Hound, Kanni, Mudhol Hound, Himalayan sheep dog and Bhutia sheep dogs (Gandhi 2010). Dog (*Canis lupus familiaris)* being the first animal domesticated by human being, belongs to subspecies of gray wolf (*Canis lupus*), a member of the family, 'Canidae' of the mammalian order, 'Carnivora'. The Indian breeds of dog are known for guarding, shepherding and hunting. Out of seven internationally known Indian dog breeds, four breeds originate from Tamil Nadu viz. Rajapalayam, Kanni, Chippiparai and Combai (Thiruvenkadan *et al.* 2012). However, adequate attention has not been given to our indigenous dog breeds in characterizing and registering as a breed at National level. Keeping this in view, the present study was undertaken to characterize the Rajapalayam dog of Tamil Nadu and develop a breed descriptor.

MATERIALS AND METHODS

Sets of questionnaires were developed for collecting information on general information of the breed, management practices, socio-economic status of dog owners, physical and morphometric traits, reproduction performance and utility of the breed in its native habitat. The survey questionnaire was developed based on the questionnaire used for phenotypic characterization of indigenous livestock species at ICAR-NBAGR, with suitable modifications as per Sutter *et al.* (2008). The survey

Present address: [1]Scientist (drknraja@gmail.com), [2,3]Principal Scientist (pksinghmathura@gmail.com, anilmishra65 @yahoo.co.in), [4]Senior Scientist (drindrajit@gmail.com), AGR Division. [5]Professor-AG&B (devauma@yahoo.com), Post Graduate Research Institute in Animal Sciences, Kattupakkam. [6]Associate Professor and Head (s.kathirvel@tanuvas.org.in), Veterinary College and Research Institute, Tirunelveli.

on Rajapalayam dog population was undertaken in Rajapalayam and adjoining villages in Virudhunagar district of southern Tamil Nadu and one Dog Breeding Unit (Dept. of Animal Husbandry, Govt. of Tamil Nadu) located at Chennai for the characterization of this dog population. Random sampling procedure was followed for collecting the data and the area surveyed has been depicted in Fig. 1. A total of twenty six each of morphometric and physical traits on 88 adult animals (19 dogs and 69 bitches) and 21 puppies (12 males and 9 females) were recorded during the study. The age of the animals was recorded based on interview and pedigree records of individual dogs available from registration certificates given by the Kennel club of India. Physical and morphometric traits considered under this study were as per the studies of Sutter *et al.* (2008) applicable for judging a dog breed. The physical traits were recorded on individual dog. The morphometric traits were recorded by using graduated measuring tape and animals were made to stand on an even ground while measuring. The body weight was recorded by using a digital weighing balance with an accuracy of one gram. The morphometric traits under study included height at withers (AB), height at base of tail (CD), body length (IJ), chest girth (2), paunch girth (3), head width, snout length, ear length, ear width, face length, neck length (GH), neck girth (1), hind foot length -WX (right and left), lower hind leg length - UV (right and left), upper hind leg length - ST (right and left), fore foot length - QR (right and left), lower fore leg length - OP (right and left), upper fore leg - MN (right and left), tail length - KL and body weight (Fig. 1). The morphometric data were analyzed and comparison mean biometry between sexes was done using one way ANOVA through SAS 9.3 software programme. All the data to study management and reproduction traits of the Rajapalayam breed were recorded through interview of 20 dog breeders from the field and incharge of the Dog Breeding Unit, Chennai.

RESULTS AND DISCUSSION

History, origin and distribution: The nomenclature for Rajapalayam dogs came from place of its origin, i.e. Rajapalayam town in Virudhunagar district of Tamil Nadu. It was believed that the Rajapalayam dogs were bred by Nayak dynasty of Tamil Nadu. It was reported that the Rajapalayam dogs were used during the Carnatic war against the British army. It was speculated that Rajapalayam

was one of the breed used in the formation of the modern Dalmatian dog. The major area of distribution of this dog population is Rajapalayam town and villages in Rajapalayam taluk and in few pockets of the adjoining areas of Madurai and Tirunelveli district of southern Tamil Nadu. These dogs are also available throughout Tamil Nadu with various private Kennels, dog breeders, dog lovers as a pet animal and with the farmers near Rajapalayam as guarding animal for farm and farm houses. The Rajapalayam dogs are mainly kept by Devar, Naicker and Nadar community for securing their home and agriculture crops. However, few wealthy people all over Tamil Nadu used to rear this animal for fancy purpose at their home. Indian army also started using Rajapalayam dogs in the international borders as guard dogs since last few decades.

Physical characteristics: Rajapalayam dogs are also called as *Vellai Moonji Naai* (white faced dog). They were medium in size with compact body, tucked-up abdomen, semi-curved tail and straight top line. Majority of the animals had white coat colour with pink skin and few animals were also observed with very light brown small patches all over body. The coat (hair) was very smooth and small in length. The head profile was straight and about 94% of animals had pink nostrils (Fig. 2A) and about 6% of animals under study had brown nostrils but all the animals had straight nasal bridge. Almost about 91% of animals had golden eyes (Fig. 2B) and only 9% of animals were with silver colour eyes (Fig. 2C) sometimes called as wall eye or blue eye. All the animals under study were having pink eye lids (Fig. 2B). The wall eye (silver eye) condition may be unilateral or bilateral. Animals with silver eyes were reported to be suffering with deafness. The deafness might also be occurred as unilateral or bilateral condition. Australian Coolie dog breed, generally with wall eye and the wall eye condition had no effect on the vision of the dog whereas, blue eyed Dalmatian were reported to have more incidence of deafness than the brown eyed Dalmatian, up to a frequency of 30% incidence rate either as unilateral or bilateral condition (Paterson and Tobias 2013). The blue eye condition in dogs might be due to Merle gene in recessive condition, depigmentation around the eyes or due to albinism associated with unknown aetiology. The observation under present study in Rajapalayam dog revealed similar results of deafness, which may be associated with the wall/blue eye condition and needs to be
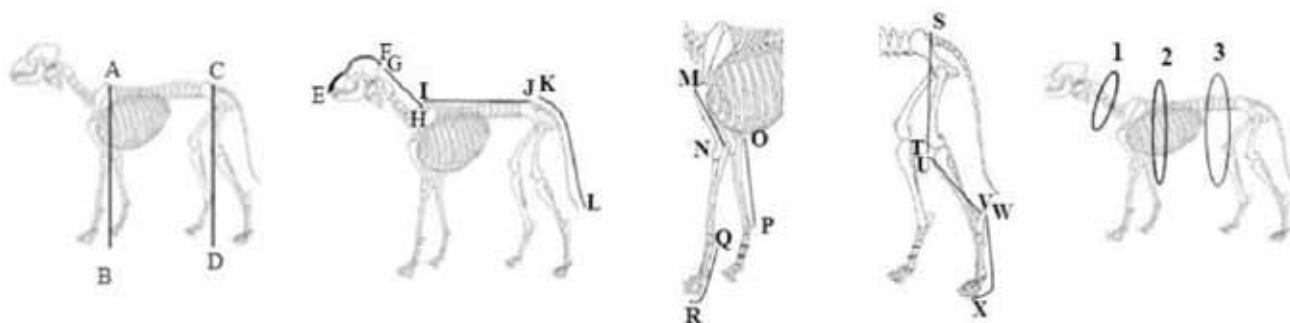

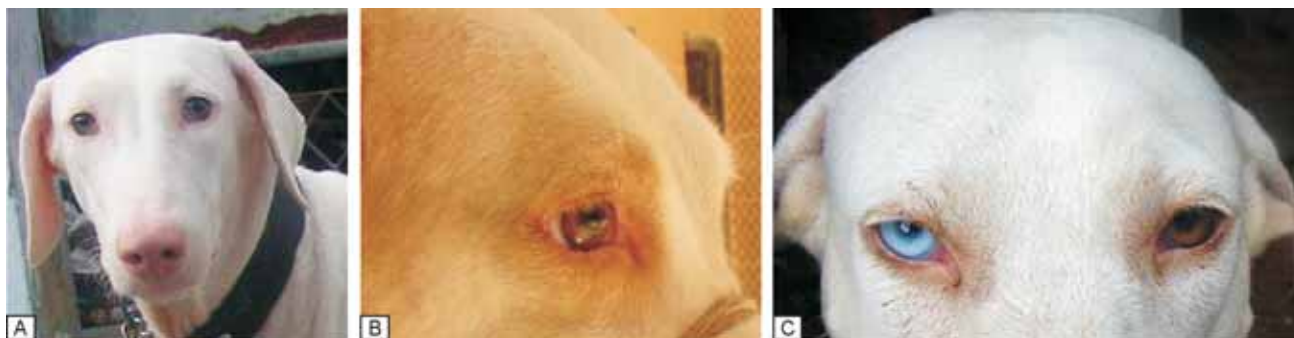Fig. 1. Various biometrical traits measured for dog breed characterization.

Fig. 2. Physical traits of Rajapalayam dog. A- Head profile, pink nostrils and dropping ears; B- Golden eye colour and pink eyelids; C- Unilateral silver eye (blue eye).

Fig. 3. Morphometric traits. A- Rajapalayam adult dog; B- Rajapalayam adult bitch**.**

studied in detail. The ears were medium in size, flat and drooping (Fig. 2A). Majority of the animals (86.54%) studied had 18 (Fore limb-5+5 and Hind Limb-4+4) nails and the remaining (13.46%) animals had 20 nails. There was a belief among the breeders that the animals with 20 nails are more aggressive than the animals with 18 nails.

Morphometric traits: Twenty six morphometric traits were recorded and the sex wise mean values along with standard errors are presented in the Table 1. The mean adult body weight for male and female was found to be 24.69±0.43 and 21.42±0.47 kg, which is slightly higher than Kanni, an indigenous hound breed of southern Tamil Nadu (23.50±1.59 kg and 18.51±1.18 kg in dogs and bitches, respectively; Selvakkumar *et al.* 2013). The mean height at withers for male and female animals were 63.10±0.91 and 58.91±0.57 cm, respectively, which is lower than the Kanni dog (male) breed distributed in near vicinity (Selvakkumar *et al.* 2013). As per the classification of hounds, Rajapalayam dog breed (Fig. 3A and B) comes under the category of mid-size hounds, for which the standard reported is 51 to 70 cm in height with a body weight between 20 to 40 kg (Yilmaz *et al.* 2007). The chest girth of adult male and female Rajapalayam animals was observed to be 67.85±0.60 and 63.38±0.63 cm, which is similar to that of Kanni dogs, reported as 67.20±1.37 and 60.69±1.52 cm by Selvakkumar *et al.* (2013). Rajapalayam dogs are also smaller in height as compared to Afghan hound, which is about 68.58 cm in height (AKC 1948) whereas, it is almost similar to the height of American fox hound and Saluki dogs, for which the height ranges from 58.42 to 71.12 cm

(AKC 2011, AKC 1971). The height at base of the tail (52.846±0.487cm) was lesser than that of height at withers indicating that this dog breed was having a slope from the chest towards the hind quarter. The neck length (18.40±0.45 and 17.53±0.21 cm) of Rajapalayam dogs were lesser as compared to Kanni dog (20.28 cm), whereas, neck girth (40.00±0.51 cm) in male animals was observed to be almost similar to that of Kanni dog (40.40±1.20 cm). The body length of Rajapalayam dog (55–60 cm) was found to be almost similar to Kanni dogs as reported by Selvakkumar *et al.* (2013). Paunch girth (48.95±1.02 and 46.55±0.71cm) was lesser than that of chest girth (67.85±0.60 and 63.38±0.63 cm) in both the sexes indicating that the breed had a tucked-up abdomen. The ear length and width were almost equal in size which leads to flat and drooping ears in this dog breed. The body length of Rajapalayam dog and bitch was observed to be 58.95±0.49 and 55.95±0.65 cm, respectively, which was much lower than the Kangal (69.19±0.76 cm) and Turkish Tazi (Sight hound) dog (60.7±0.55cm) breeds of Turkey (Erdogan *et al.* 2012, Yilmaz *et al.* 2012). All the parameters of hind leg were higher than that of the fore leg which indicates that this dog can run faster which is one of the characters of guard dogs. Tail length was observed to be 41.55±0.62 and 38.20±0.43 cm in male and female animals, respectively, and with semi-curved shape (Fig. 3A and B). Out of 26 phenotypic traits studied, 16 traits were observed to be significantly higher in males as compared female which might be due to the sex effect (Table 1).

Reproduction traits: In bitches, age at first estrous ranged from 12–15 months while duration of estrus ranged from 13 to 21 days after estrous bleeding. The mating was practiced on 9th, 11th and 13th day post estrous bleeding. Breeders used to mate the females for the first time at the age of 18–24 months (age at first mating) whereas, in case of dogs, the first mating used to be at the age of 24–30 months. The main breeding season as reported by the breeder was November to January; with a gestation length of 2 months. The age at first whelping ranged between 21–27 months with a whelping interval of 8–12 months and number of whelping in lifetime was reported to be 10 to 12. The litter size ranged from 4 to10 and age at weaning was 30–45 days. Breeders reported up to 40% pup mortality.

Sale price of pups ranged between ₹ 12000/- to 25000/- per pair (male and female). In Dog Breeding Unit, Chennai, the sale price was ₹ 1500/- and ₹ 1250/- for male and female pups, respectively, during the year 2013. Rajapalayam dog owners used to avoid closely related mating to negate the inbreeding related problems like wall eye (blue eye) associated deafness.

Management practices

Housing: Rajapalayam dogs preferred to live alone in its house. Most of the breeders (62.5%) used to keep their animals in separate Katcha or Pucca house (Fig. 4 A and B); whereas, 37.5% of the breeders house their animals in the portion as a part of their own house with Pucca flooring. Separate houses of keeping individual animal in a cage were made up of iron mesh (Fig. 4 C) or as in a group. The size of iron cages used for housing Rajapalayam dogs were approximately 3' × 2.7' × 2.9' (height × width × length). Few breeders reported that the animals were let loose in the coconut garden during day time.

Feeding: The dogs were maintained mostly on non-vegetarian food, along with rice, egg and milk. Majority of the breeders (62.5%) followed twice a day feeding (morning and night) but about 25% of the breeders followed once in a day feeding (night only) and very few breeders (12.5%) followed thrice a day feeding (morning, noon and night). Aluminum/stainless steel utensils were used by majority

Table 1. Morphometric traits of adult Rajapalayam dog breed

Trait (cm)	Dog (N=19) (Mean±SE)	Bitch (N=69) (Mean±SE)
Height at withers	63.10±0.91	58.91±0.57**
Height at base of tail	56.63±1.03	52.54±0.52**
Body length	58.95±0.49	55.95±0.65**
Chest girth	67.85±0.60	63.38±0.63**
Paunch girth	48.95±1.02	46.55±0.71
Head width	06.20±0.16	06.02±0.07
Snout length	10.73±0.25	10.44±0.18
Ear length	12.33±0.23	11.46±0.14*
Ear width	10.06±0.26	09.36±0.15*
Face length	21.30±0.35	19.41±0.34**
Neck length	18.40±0.45	17.53±0.21
Neck girth	40.00±0.51	36.64±0.40**
Hind foot length - Right	23.65±1.08	20.86±0.28**
Hind foot length - Left	23.73±1.06	20.75±0.29**
Lower hind leg length - R	25.95±0.63	23.24±0.39**
Lower hind leg length - L	26.10±0.62	23.35±0.37**
Upper hind leg length - R	22.95±0.42	21.98±0.20*
Upper hind leg length - L	22.98±0.46	21.89±0.18*
Fore foot length - R	15.95±0.75	14.88±0.36
Fore foot length - L	15.85±0.70	14.85±0.37
Lower fore leg length - R	19.95±0.73	18.50±0.42
Lower fore leg length - L	20.13±0.72	18.40±0.42
Upper fore leg length - R	21.30±0.27	20.30±0.21*
Upper fore leg length - L	21.30±0.27	20.23±0.21*
Tail length	41.55±0.62	38.20±0.43**
Body weight (kg)	24.69±0.43	21.42±0.47**

**P<0.001; *P<0.05.

of the breeders (Fig. 4 D) to feed their animals. Breeders used to cook chicken or mutton/chevon offal along with rice and fed to their animals. Young animals and breeding females were fed with milk and boiled eggs. Ready to feed dog foods like pedigree was preferred by few breeders only.

Breeding: Dogs were mostly seasonal breeders with one or two breeding cycle in a year. Rajapalayam bitches were having one breeding cycle in a year and used to be bred during the months of November to January, which is the only breeding season. Breeders used to follow planned mating of their bitches with dogs of other lines to avoid inbreeding. Majority of the breeders used to keep the dogs and bitches in separate places to avoid unwanted mating during breeding season.

Health management: Majority (>95%) of the Rajapalayam dog breeders used to follow strict vaccination schedule. The animals were vaccinated for major diseases like parvo, rabies etc., followed by booster doses and the same was repeated once in a year and dewormed once in four months. Along with the above said vaccine, the other most commonly used vaccine to vaccinate the dogs were combined vaccine containing the antigen for seven viral diseases viz. Canine Distemper, Hepatitis (CAV-2), Parvovirus, Hepatitis (CAV-1), Parainfluenza, *Leptospira canicola* and *Leptospira icterohaemorrhagiae*. The breeders also reported dermatitis problem in Rajapalayam animals. About 70% of the breeders used to bath the animals once in a week or 10 days with shampoo or soaps available exclusively for dogs. Few breeders (20%) reported bathing their animals daily or alternate days to manage the dermatitis and other skin related problems and about 10% of the breeders reported bathing at an interval of one month.

Utility: Rajapalayam dogs are individual dogs preferred to be alone along with the owner. The animals were very active, obedient to owner, easily trainable and will not attack the other species of livestock and poultry in their own farm. The breeders/farmers near Rajapalayam town, whose farms are located in the foot hills of eastern side of the Western Ghats used to rear their animals in their farm houses and used Rajapalayam as a guarding dog for the protection against the wild boars from the nearby forest. Wild boars are one of the important problems for the farmers, which used to destroy the crops like tapioca, paddy and banana during night time. Rajapalayam animals used to be very alert against the unknown persons and wild animals. Hence the farmers prefer Rajapalayam animals as a watch dog for their agriculture crops. Apart from the guarding purpose, the farmers/breeders earn money by selling the puppies as there was a great demand for Rajapalayam pups.

Economics of Rajapalayam dog keeping: A case study was conducted during the year 2013–14, with one of the breeder Mr. Pon Elangovan near Rajapalayam town who was rearing this dog for the last twenty years. He was having 17 adult Rajapalayam dogs (15 bitches and 2 male dogs) along with chicken (desi), turkey etc., in his farm house in the foot hills of Western Ghats. The economics of Rajapalayam dog keeping at the dog unit of Mr. Pon

Fig. 4. Management practices followed for Rajapalayam dog rearing. A- Pucca housing; B-Katcha housing; C-Cage type housing; D- Feeding utensils.

Table 2. Economics of Rajapalayam dog keeping

Item	Amount (in ₹)
Annual food of Dog and Bitch (@ ₹ 50/day per animal ($17 \times ₹ 50 \times 365$)	3.10 lakhs
Annual expenses on health management (vaccine and vaccination charges and deworming)	0.30 lakhs
Other miscellaneous expenditures including pup management for one year	0.80 lakhs
Total expenditure in a year (A)	4.20 lakhs
Annual gross income by sale of puppies (36 pairs $\times ₹ 14,000$) - (B)	5.40 lakhs
Net income (B-A)	₹ 1.20 lakhs per year
Approximately ₹ 10, 000/- per month	

Elangovan was worked out (Table 2). The economics was worked out based on facts narrated by the dog owner, which included one whelping/year, average number of puppies/whelping as 6, average pup mortality as 20% and rate of a pair (one male and one female) of one month old puppies as ₹ 14,000 he was selling on an average a total of 36 pair of puppies in a year.

Present study revealed that the Rajapalayam dog population of southern India well deserves the status of a breed in view of its morphological uniformity, utility, passion for keeping Rajapalayam dog and heavy demand for the puppies among the farmers, dog breeders, pet lovers and Kennel clubs. Therefore, Rajapalayam canine germplasm should be registered as a breed of indigenous dog through the national registration system of livestock and poultry breeds developed by Indian Council of Agricultural Research in India. Regular camps on scientific breeding, healthcare and management may be organized for production of good quality pups to fulfill its heavy demand for puppies. Dog shows may be organized at regular interval, preferably in the native tract of Rajapalayam dog, to recognize and reward the dog owners and make this business more profitable. Society of Rajapalayam dog owners may be established at local level to take care promotional and marketing issues at district/state levels.

ACKNOWLEDGEMENT

REFERENCES

AKC. 1948. American Kennel Club - Official Standards for the Afghan Hound. http://www.akc.org/dog-breeds/afghan-hound.

AKC. 1971. American Kennel Club - Official Standards for the Saluki. http://www.akc.org/dog-breeds/saluki/.

AKC. 2011. American Kennel Club - Official Standards for the American Foxhound. http://www.akc.org/dog-breeds/american-foxhound/.

Erdogan M, Tepeli C, Ozbeyaz C D, Akbulut M and Uguz C. 2012. Comparision of some morphological characteristics of native Turkish dog breeds. *Eurasian Journal of Veterinary Science* **28**(2): 106–10.

Gandhi M. 2010. Breeds of Dog in India. *The Bihar Times,* dated 11.12.2010.

Selvakkumar R, Murugan M and Sivakumar T. 2013. Morphometric characterization of Kanni dog- an indigenous hound breed of southern Tamil Nadu. *Indian Veterinary Journal* **90**(8): 32–33.

Sue Paterson and Karen M Tobias. 2013. Atlas of ear diseases of the dog and cat. *Wiley- Blackwell*, John Wiley and Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK, 174 pp.

Sutter N B, Mosher D S, Gray M M and Ostrander E A. 2008. Morphometrics within dog breeds are highly reproducible and dispute Rensch's rule. *Mammalian Genome Official Journal of the International Mammalian Genome Society* **19** (10–12): 713–23.

Thiruvenkadan A K, Ravimurugan T, Devendran P and Sivakumar K. 2012. Dog Breeds of Tamil Nadu. A leaflet published by Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu, India.

Yilmaz O. 2007. 'Some Morphological Characteristics of Kangal Dogs Raised in Various Regions of Turkey'. PhD. thesis. University of Ankara, Faculty of Agriculture, Department of Animal Science, Ankara.

Yilmaz O, Coskun F and Ertugrul M. 2012. Live weight and some morphological characteristics of Turkish Tazi (Sighthound) raised in Province of Konya in Turkey. *Journal of Livestock Science* **3**: 98–103.