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Body and Head Morphometric of Kacang Goat under Semi Intensive Management at Fishpond Area in Sidoarjo Regency, Indonesia

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Abstract. Morphometric characterization is the basis of conservation strategies, performance improvement, breeding, and sustainable utilization plan. The purpose of this research was to determine the morphometrics of the Kacang Goats at the fishpond area in Sidoarjo Regency based on different ages and sex. The fishpond area in Sidoarjo is a closed area where goats are raised and have the potential for inbreeding with the consequence of smaller-sized offspring than normal. Morphometric measurements included the head, ears, neck, body, legs, tail, and horns. This research used a descriptive analysis approach, presenting data in form of mean, standard deviation, and coefficient of variation. The result showed that the average face length of male vs. female Kacang goats was 16.73 ± 2.40 cm vs. 19.68 ± 2.44 cm; with a face width of 11.25 ± 2.91 cm vs. 19.52 ± 3.18 cm; ear length of 14.62 ± 1.38 cm vs. 16.46 ± 1.47 cm; neck length of 15.53 ± 2.65 cm vs. 15.35 ± 2.14 cm; horn length of 7.41 ± 4.10 cm vs. 6.59 ± 2.89 cm; chest circumference of 59.33 ± 8.18 cm vs. 67.80 ± 6.32 cm; body length of 51.45 ± 6.70 cm vs. 56.91 ± 6.54 cm; body height of 54.41 ± 7.22 cm vs. 62.01 ± 5.53 cm; tail length of 13.21 ± 2.01 cm vs. 14.77 ± 3.37 cm; hind leg length of 39.20 ± 5.26 cm vs. 47.74 ± 5.47 cm; and front leg length of 37.00 ± 8.84 cm vs. 44.63 ± 8.65 cm. This research concludes that Kacang Goats in Sidoarjo has characteristics according to SNI standard, and the morphometric size was larger in female than male goats.

Keywords: leg length, body height, head length, ear length, chest circumference

Abstrak. Karakterisasi morfometrik adalah dasar dari strategi konservasi, peningkatan performa, pemuliaan dan rencana pemanfaatan berkelanjutan. Tujuan dari penelitian ini ialah untuk mengetahui morfometrik kambing kacang yang ada di daerah tambak Sidoarjo berdasarkan perbedaan umur dan jenis kelamin. Pengukuran morfometrik yang dilakukan meliputi pengukuran kepala, telinga, leher, tubuh, kaki, ekor dan tanduk. Penelitian ini menggunakan metode deskripstif dengan penyajian data dalam bentuk rata-rata, standar deviasi dan koefisien variasi. Hasil dari penelitian ini menunjukkan bahwa secara keseluruhan rata-rata panjang wajah pada kambing kacang jantan 16.73 ± 2.40 cm, lebar wajah 11.25 ± 2.91 cm, panjang telinga 14.62 ± 1.38 cm, panjang leher 15.53 ± 2.65 cm, panjang tanduk 7.41 ± 4.10 cm, lingkar dada 59.33 ± 8.18 cm, panjang badan 51.45 ± 6.70 cm, tinggi badan 54.41 ± 7.22 cm, panjang ekor 13.21 ± 2.01 cm, panjang kaki belakang 39.20 ± 5.26 cm dan panjang kaki depan 37.00 ± 8.84 cm. Rata-rata panjang wajah pada Kambing Kacang betina adalah 19.68 ± 2.44 cm, lebar wajah 19.52 ± 3.18 cm, panjang telinga 16.46 ± 1.47 cm, panjang leher 15.35 ± 2.14 cm, panjang tanduk 6.59 ± 2.89 cm, lingkar dada 67.80 ± 6.32 cm, panjang badan 56.91 ± 6.54 cm, tinggi badan 62.01 ± 5.53 cm, panjang ekor 14.77 ± 3.37 cm, panjang kaki belakang 47.74 ± 5.47 cm dan panjang kaki depan 44.63 ± 8.65 cm. Kesimpulan dari penelitian ini adalah Kambing Kacang yang dipelihara di area tambak Sidoarjo memiliki karakteristik yang sesuai dengan standar SNI dan ukuran morfometrik kambing betina lebih besar daripada kambing jantan.

Kata kunci: panjang kaki, tinggi badan, panjang kepala, panjang telinga, lingkar dada

Introduction

Kacang goat is one of the local breeds in Indonesia (Nasich et al., 2018) that has small and short body, short and vertical ears, raised back, non-polled goat, and body color of black, brown, white, or mixed color (Wahyuni et al., 2016). These goats are adaptable, more resistant to disease, productive despite the harsh environmental conditions (Mahmilia and Doloksaribu, 2010), and their litter size is 1.31-1.69 (Suyadi et al., 2019; Wulandari et al., 2022). These characteristics are the contributing factors to farmers' selection of Kacang goats as their livestock.

As one of Indonesian animal genetic resources, the existence of Lacang goats must be

preserved. It has been a common practice that farmers crossbreed Kacang goats without any recording for increasing productivity. When let continued, this crossbreeding practice may harmfully diminish the purity of Kacang goat straun. In Sawohan Village, Sidoarjo, some Kacang goats are raised in a closed population which allows the occurrence of inbreeding with a risk of decreased performance of goats. In order to preserve the genetic resources of native Indonesian Animal, it is crucial to conduct animal breeding based on qualitative and quantitative traits. Quantitative traits include measurements of body weight, age, height, and body length (Tatang et al., 2016).

The morphometric data are utilized to estimate body weight and to describe the body shape of the breed (Azmidaryanti et al., 2017). Mapping morphometric characteristics is crucial for conservation strategies, planning for performance improvement, and breeding and sustainable utilization (FAO, 2012). To obtain morphometric data, body measurement can be a simple method to gather and describe genetic variations. Previous studies reported the correlation between body sizes and body weight (Takaendengan et al., 2011). This study aims to determine body morphometric characteristics of Kacang goats in Sawohan Village, Buduran subdistrict, Sidoarjo. The results of this study are expected to provide further information in breeding selection, particularly Kacang goats.

Material and Method

This study used a total of 112 kacang goats (60 males and 52 females) from Sawohan Village, Buduran District, Sidoarjo that were raised in semi-intensive maintenance which allowed the livestock to feed in the pasture during the day, then housed and fed them in the afternoon. The goats were grouped based on age, namely PI 1(1-1.5 years), PI 2(1.5 – 2 years), PI 3 (2.5 – 3.5 years). The quantitative data were collected in the field directly in Sawohan Village, Buduran District, Sidoarjo using a measuring tape and stick to take body measurements of the goats that included the size of head, ear, body, foot, and tail. Head length was measured from head point to the posterior point, while the head width was from left and right outermost point of skull protrusion. Measurement of the ear from the base of the ear to the tip of the ear. Body length was measured from the distance between the protrusion of the shoulder (Tuberculum humerus lateralis) to the protrusion of the sitting bone (Tuberculum ischiadicum), and body height perpendicular was from the highest point of the spine (Vetebrae thoracalis) to the ground level behind the front legs. Chest circumference was measured from the coil near the scapula or hind forefoot (behind elbow). The length of leg was measured from the part of the bone that protrudes from the front of the chest to the ground. Length of tail measured from the base of the tail to the tip of the tail. Data was calculated using purposive sampling technique. Analysis of body morphometrics were obtained using formula (Setiawan, et al., 2005):

$$\mu = \frac{\sum Xi}{n} \qquad SD = \sqrt{\frac{\sum (Xi-\mu)2}{n-1}}$$

Description:
SD = Standard Deviation
Xi = each sample value in the data
μ = Mean of all sample
n = Total sample

Results and Discussion

Overall, the body size of Kacang goats in Sidoarjo has a normal size according to SNI. This research obtained quantitative data of male and female Kacang goats in Sawohan Village, Buduran District, Sidoarjo as shown in Table 1 though Table 4.

Figure 1. (i) Male kacang goat; (ii) Female kacang goat

Table 1. Mean value of face length and width Kacang Goat in Sidoarjo

Sex	Age	Total	Face length (cm)	Face width (cm)
Male	PI 1	36	11.51 ± 2.77	5.72 ± 2.53
	PI 2	19	18.28 ± 3.90	13.84 ± 4.91
	PI 3	5	20.40 ± 0.54	14.20 ± 1.30
Female	PI 1	22	18.18 ± 3.32	17.77 ± 2.94
	PI 2	16	20.44 ± 1.86	20.44 ± 2.73
	PI 3	14	20.43 ± 2.14	20.36 ± 3.86

Description: PI 1= 1-1.5 years; PI 2= 1.5-2 years; PI 3= 2.5-3.5 years

Table 2. Mean values of ear length, neck, and horn Kacang Goat in Sidoarjo

Sex	Age	Total	Ear length (cm)	Neck length (cm)	Horn length (cm)
Male	PI 1	36	13.65 ± 1.33	13.67 ± 2.00	4.02 ± 3.32
	PI 2	19	14.52 ± 1.51	15.02 ± 3.95	7.02 ± 3.74
	PI 3	5	15.70 ± 1.30	17.90 ± 2.01	11.20 ± 5.11
Female	PI 1	22	15.63 ± 1.68	14.23 ± 2.28	4.36 ± 3.81
	PI 2	16	16.31 ± 1.44	15.81 ± 2.19	7.62 ± 2.83
	PI 3	14	17.43 ± 1.28	16.00 ± 1.96	7.78 ± 2.04

Description: PI 1= 1-1.5 years; PI 2= 1.5-2 years; PI 3= 2.5-3.5 years

Head size of Kacang Goat (Table 1 dan Tabel 2) generally increases with age. As explained by a previous study (Niam et al., 2012), as the goats grow older, the body weight and the appearance of vital statistics would increase. After birth, head and feet grow earlier but the body, especially the back, will grow slowly and become the last part to reach adult size (Syawal et al., 2013). While fast growth to reach adult size relatively occurs in the bones of head, thighs, front and hind legs, the relatively medium growth occurs in the bones of the thoracic cavity and shoulder. According to Azmidaryanti et al. (2017), Kacang Goats that are raised semi-intensively in Riau Province have face length of 13.94 cm, ear length of 11.90 cm, chest circumference of 55.16 cm, body length of 49.06 cm, front legs of 35.55 cm, hind legs of 43.76 cm and tail length of 11.22 cm. Meanwhile, Kacang goat reared semi-intensively in Sidoarjo showed higher results. It happens because of differences in genetic, environment, and maintenance management of the goats (Adhianto et al., 2016). The average size of horn was longer in male than female Kacang goat because male Kacang Goat use their horns as a defensive tool to get food or when fighting over females for mating.

Table 3. Mean values of chest circumference, body length and height Kacang Goat in Sidoarjo

Sex	Age	Total	Chest circumference (cm)	Body length (cm)	Body height (cm)
Male	PI 1	36	50.20 ± 8.77	44.41 ± 7.25	47.66 ± 7.11
	PI 2	19	58.60 ± 11.70	47.13 ± 7.75	54.78 ± 11.13
	PI 3	5	69.20 ± 4.08	62.8 ± 5.11	60.80 ± 3.42
Female	PI 1	22	59.46 ± 10.20	51.59 ± 8.00	55.59 ± 8.73
	PI 2	16	70.81 ± 4.28	57.44 ± 7.82	65.31 ± 3.15
	PI 3	14	73.14 ± 4.49	61.71 ± 3.79	65.14 ± 4.70

Description: PI 1= 1-1.5 years; PI 2= 1.5-2 years; PI 3= 2.5-3.5 years

Table 4. Mean values of tail length, hind leg and front leg Kacang Goat in Sidoarjo

Sex	Age	Total	Tail lenght (cm)	Length of hind leg (cm)	Length of front leg (cm)
Male	PI 1	36	11.86 ± 2.23	35.40 ± 6.15	30.31 ± 5.47
	PI 2	19	13.36 ± 3.03	39.21 ± 7.63	36.20 ± 6.45
	PI 3	5	14.40 ± 0.77	43.00 ± 2.01	44.50 ± 14.61
Female	PI 1	22	13.59 ± 2.52	45.00 ± 7.68	41.18 ± 8.57
	PI 2	16	14.38 ± 3.07	50.93 ± 4.01	44.06 ± 9.99
	PI 3	14	16.35 ± 4.52	53.29 ± 4.73	48.64 ± 7.38

Description: PI 1= 1-1.5 years; PI 2= 1.5-2 years; PI 3= 2.5-3.5 years

According to Solehudin et al. (2019), a pair of horns on the goat's head may reflect the performance of the goat. Horn growth is influenced by extrinsic and intrinsic factors that include genetic and reproductive status.

Table 3 shows that the average chest circumference, body length, and height of female Kacang goats in Sidoarjo are 1-5 cm greater than the chest circumference of female Kacang goats in Grobogan, Central Java. The average chest circumference of Kacang goats in Sidoarjo aged 1.5-2 years is around 58.60 cm in male, or within the normal category. It was similar to that of Kacang goats raised in Jambi with chest circumference of 58.09 cm (Depison, et al., 2020). While the average chest circumference of female Kacang goats in Sidoarjo aged 2.5-3.5 years is 73.14 cm, Kacang goat raised in Gorontalo was 69.42 cm (Putra and Ilham, 2019). This condition may be due to environmental factors and maintenance management in which farmers lead the goats to the grazing area. Kacang goats preferred the grass in this area for its freshness and high palatability. In addition, farmers offered hibiscus leaves to the goats.

The body size of female Kacang goat in Sidoarjo carries more potential as Kacang goat dam because their large chest circumference represents good capability to produce large body weight (Putri, et al., 2014). Body length and height are correlated with the ability of dam to give birth to twins. Dam with large body structures is usually able to give birth to more than one offspring (Sutiyono, et al., 2006). In line with Trisnawanto, et al. (2012), Kacang goats' body size increases with age. More specifically, the enlarged chest circumference indicates the growth of the ribs with age. It is in conjunction with Victoria et al. (2016) that size of the goat's chest would grow with the growth of the goat's ribs. In addition, the body size of Kacang goats in Sidoarjo were in accordance with the standards stipulated in the Decree of Tthe Minister of Agriculture of Indonesia that chest circumference, body length and height of female Kacang goats are 63.2 cm, 58.9 cm, and 55.6 cm, respectively.The height of offspring shoulder will follow the shape of parent's body. Good production aspect in dam influence production of her offspring (Nafiu et al., 2020). While the constituent bone of front legs is related to shoulder height while the length of hind legs is related to hip height (Syawal et al., 2013). The leg size of Kacang goat in Sidoarjo (Table 4) is longer than that of the Kacang goat in

Jeneponto, South Sulawesi (±36.47 cm), so Kacang goats in Sidoarjo are bigger in size and potentially pass this trait on to their offspring. Head and feet are the parts of the body that develop earlier than the rest body parts. This condition occurs because of the function of the feet to support their body (Septian et al., 2015).

Conclusions

In general, Kacang goats in Sawohan Village, Buduran Sub-District, Sidoarjo grow optimally as shown by their morphometric size which conforms to the standards stipulated in the Decree of the Minister of Agriculture No. 2840/Kpts/Lb.430/8/2012 on Determining Kacang Goat Breed, and Agricultural Balitbang in Indonesia 2012.

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