

Evaluation of morphometric characteristics of female peranakan Etawah goats based on the Indonesian National Standard in Karangasem Regency, Bali

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Abstract

The selection of superior female breeding stock is essential for improving the genetic quality and productivity of Peranakan Etawah (PE) goats. This study aimed to evaluate the morphometric characteristics of female PE goats as candidate breeding stock based on the Indonesian National Standard (SNI 7352.1:2015) in Karangasem Regency, Bali. A total of 217 female PE goats from ten farmer groups were selected using purposive sampling and classified into three age groups: I0 (<8 months), I1 (8–12 months), and I2 (>12–18 months). Morphometric measurements included withers height, chest girth, body length, chest width, ear length, head length, head width, cannon circumference, and body condition score (BCS). Data were analyzed descriptively using mean, standard deviation, and coefficient of variation (CV). The results showed that female PE goats in the I1 and I2 age groups exceeded the minimum morphometric requirements specified in SNI 7352.1:2015. Mean withers height reached 72.93 ± 5.66 cm and 72.50 ± 6.00 , chest girth 77.17 ± 7.99 cm and 76.61 ± 7.10 cm, and body length 73.97 ± 8.67 cm and 72.91 ± 8.80 cm for the I1 and I2 groups, respectively. The coefficient of variation ranged from 7.76–22.41% for most morphometric traits, indicating relatively uniform body measurements, whereas BCS showed higher variation (41.72–42.81%). These findings indicate that female PE goats in Karangasem possess morphometric characteristics that comply with the national breeding standard and have good potential to be selected as candidate breeding stock.

Keywords: Body Measurements; Breeding Selection; Morphometric Traits; Peranakan Etawah Goat; Candidate Breeding Females

1. Introduction

Peranakan Etawah (PE) goats are one of Indonesia's important local genetic resources and have been officially recognized as a national breed through the Decree of the Minister of Agriculture No. 695/Kpts/PD.410/2/2013. As a dual-purpose breed, PE goats are widely raised for both meat and milk production because of their adaptability to tropical environments, relatively high reproductive performance, and economic value for smallholder farmers [1,2,3]. Consequently, maintaining the genetic quality of PE goats through an effective breeding program is essential to improve livestock productivity and ensure the sustainability of this valuable genetic resource. The PE goat population in Bali has shown a declining trend in recent years. According to the Bali Provincial Department of Agriculture and Food Security, the population decreased from 45,102 head in 2019 to 41,817 head in 2023. Karangasem Regency remains the largest production area for PE goats in Bali, contributing approximately 15.38% of the provincial goat population [4]. A continuous decline in population without systematic selection of superior breeding stock may reduce both the productivity and genetic potential of the breed.

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The selection of superior breeding animals is a fundamental component of livestock genetic improvement. In female goats, body size and conformation are important selection criteria because they are associated with growth performance, reproductive efficiency, longevity, and productive potential [5,6]. Morphometric measurements such as withers height, body length, chest girth, chest width, ear length, and cannon circumference are widely used as practical indicators in breeding programs because they are simple to measure under field conditions and reflect body development [7,8]. To standardize the selection of breeding stock, Indonesia established the Indonesian National Standard (SNI 7352.1:2015), which specifies the minimum morphometric requirements for Peranakan Etawah breeding goats according to age category [9]. The application of these standards enables objective identification of superior breeding animals while supporting genetic improvement and breed conservation. However, the effectiveness of SNI-based selection depends on the evaluation of local goat populations because environmental conditions, management practices, and breeding systems may influence body development.

Several studies have reported the morphometric characteristics and genetic parameters of Peranakan Etawah goats in different regions of Indonesia [7,8,10,11]. However, information regarding the conformity of female PE goats in Karangasem Regency with the morphometric requirements specified in SNI 7352.1:2015 is still limited. Such information is important because Karangasem is the main PE goat production area in Bali and plays a strategic role in supplying breeding stock. Therefore, this study aimed to evaluate the morphometric characteristics of female Peranakan Etawah goats in Karangasem Regency based on the Indonesian National Standard (SNI 7352.1:2015) and to identify animals that meet the requirements as candidate breeding stock.

2. Materials and Methods

2.1. Study Area

This study was conducted from August to October 2025 in Karangasem Regency, Bali Province, Indonesia. The study site was purposively selected because Karangasem has the largest population of Peranakan Etawah (PE) goats in Bali Province.

2.2. Animals and data collection

A total of 217 female Peranakan Etawah (PE) goats were selected from ten farmer groups using purposive sampling. The animals were grouped according to age based on permanent incisor eruption into three categories: I0 (<8 months), I1 (8–12 months), and I2 (>12–18 months), following the age classification specified in the Indonesian National Standard (SNI 7352.1:2015) for breeding stock evaluation.

2.3. Morphometric measurements

Morphometric measurements were performed directly on each animal following the procedures described in SNI 7352.1:2015. The variables measured included withers height (cm), body length (cm), chest girth (cm), chest width (cm), ear length (cm), head length (cm), head width (cm), cannon circumference (cm), and body condition score (BCS). Body measurements were obtained using a measuring stick and measuring tape, whereas BCS was assessed using a five-point scoring system based on body fat reserves.

2.4. Statistical analysis

Data were analyzed using descriptive statistics. The mean, standard deviation (SD), and coefficient of variation (CV) were calculated for each morphometric trait within each age group. The coefficient of variation was calculated as:

$$CV(\%) = \frac{SD}{Mean} \times 100$$

The descriptive analysis was used to evaluate phenotypic variation among age groups and determine the conformity of female PE goats with the national breeding standard (SNI 7352.1:2015).

3. Results

3.1. Morphometric Characteristics of Female Peranakan Etawah Goats

The morphometric measurements of female Peranakan Etawah (PE) goats in Karangasem Regency are presented in Table 1. The evaluated traits included withers height, chest girth, body length, chest width, ear length, body condition

score (BCS), head length, head width, and cannon circumference. Data are presented as mean $\pm$ standard deviation for each age group (I0, I1, and I2).

Table 1 Mean ($\pm$ SD) morphometric measurements of female Peranakan Etawah goats by age group

Morphometric Trait	Age Group (Based on Dentition)		
	I0	I1	I2
Withers height (cm)	56.69 $\pm$ 9.41	72.93 $\pm$ 5.66	72.50 $\pm$ 6.00
Chest girth (cm)	59.19 $\pm$ 11.68	77.17 $\pm$ 7.99	76.61 $\pm$ 7.10
Body length (cm)	53.83 $\pm$ 9.83	73.97 $\pm$ 8.67	72.91 $\pm$ 8.80
Chest width (cm)	12.47 $\pm$ 2.76	14.03 $\pm$ 2.76	15.15 $\pm$ 3.40
Ear length (cm)	25.96 $\pm$ 3.47	27.71 $\pm$ 3.23	27.45 $\pm$ 3.66
BCS	1.56 $\pm$ 0.65	1.58 $\pm$ 0.67	1.46 $\pm$ 0.61
Head length (cm)	16.06 $\pm$ 5.67	22.90 $\pm$ 3.52	17.87 $\pm$ 3.57
Head width (cm)	10.92 $\pm$ 1.75	13.05 $\pm$ 1.65	13.39 $\pm$ 2.34
Cannon circumference (cm)	7.03 $\pm$ 1.25	8.32 $\pm$ 0.75	8.20 $\pm$ 0.95

Note: I0 = <8 months; I1 = 8–12 months; I2 = >12–18 months.

As shown in Table 1, body measurements increased with age. The I0 group (<8 months) exhibited the smallest body dimensions, whereas the I1 (8–12 months) and I2 (>12–18 months) groups showed larger body sizes. The mean withers height increased from 56.69 $\pm$ 9.41 cm in I0 to 72.93 $\pm$ 5.66 cm in I1 and 72.50 $\pm$ 6.00 cm in I2. Chest girth increased from 59.19 $\pm$ 11.68 cm in I0 to 77.17 $\pm$ 7.99 cm and 76.61 $\pm$ 7.10 cm in I1 and I2, respectively. Likewise, body length increased from 53.83 $\pm$ 9.83 cm to 73.97 $\pm$ 8.67 cm and 72.91 $\pm$ 8.80 cm. Similar increasing trends were observed for chest width, ear length, head length, head width, and cannon circumference. Comparison with the Indonesian National Standard (SNI 7352.1:2015) showed that the average values of withers height, chest girth, body length, and ear length in the I1 and I2 age groups met or exceeded the minimum requirements for female breeding stock. The mean body condition score ranged from 1.46 to 1.58 across the three age groups.

3.2. Coefficient of Variation of Morphometric Traits

The coefficients of variation (CV) of morphometric traits for female PE goats are presented in Table 2. The CV was calculated to describe the relative variation of each morphometric trait within each age group.

Table 2 Coefficient of Variation (CV) of Morphometric Traits of Female Peranakan Etawah Goats.

Morphometric Trait	Age Group (Based on Dentition)					
	n	I0	n	I1	n	I2
Withers height (%)	36	16.6	59	7.76	122	8.28
Chest girth (%)		19.73		10.36		9.27
Body length (%)		18.25		11.72		12.07
Chest width (%)		22.12		19.67		22.41
Ear length (%)		13.36		11.64		13.34
BCS (%)		41.93		42.81		41.72
Head length (%)		35.33		15.36		19.95
Head width (%)		16		12.68		17.48
Cannon circumference (%)		17.83		9.05		11.54

Note: I0 = <8 months; I1 = 8–12 months; I2 = >12–18 months.

As shown in Table 2, the coefficients of variation differed among morphometric traits and age groups. Most body measurements exhibited CV values ranging from 7.76% to 22.41%. Lower CV values were observed for withers height, chest girth, body length, ear length, head width, and cannon circumference, particularly in the I1 and I2 age groups. In contrast, higher CV values were generally recorded in the I0 group for several morphometric traits. Among the evaluated variables, body condition score (BCS) exhibited the highest coefficient of variation in all age groups, ranging from 41.72% to 42.81%. Head length also showed relatively high variation in the I0 age group (35.33%) compared with the I1 (15.36%) and I2 (19.95%) groups. Conversely, withers height exhibited the lowest coefficient of variation in the I1 (7.76%) and I2 (8.28%) groups. Overall, the CV values of most morphometric traits tended to decrease from the I0 group to the I1 and I2 groups, indicating lower variation among older animals.

4. Discussion

4.1. Morphometric characteristics of female Peranakan Etawah Goats

The present study showed that most morphometric measurements of female Peranakan Etawah (PE) goats were greater in older age groups. The highest values of withers height, chest girth, body length, chest width, ear length, head dimensions, and cannon circumference were recorded in the I2 group, followed by the I1 and I0 groups. This finding indicates continuous body development with increasing age and agrees with Hardjosubroto, who stated that body measurements are important quantitative traits used for livestock selection because they are inherited and closely related to growth performance [5]. Likewise, Noor [6] explained that quantitative traits represent the phenotypic expression of genetic potential under environmental influences and therefore can be used as selection criteria.

The average values of the main morphometric traits, particularly withers height, chest girth, body length, and ear length, in the I1 and I2 groups fulfilled the minimum requirements of SNI 7352.1:2015 for female PE breeding stock. These results indicate that most goats evaluated in Karangasem Regency have body dimensions suitable for selection as candidate breeding stock. Similar results were reported by Ardika et al., who demonstrated that PE goats meeting the SNI morphometric criteria could be selected as superior breeding animals based on body measurements and breeding values [10]. Mudawamah et al. also reported that morphometric characteristics are useful indicators for identifying superior PE goats in breeding programs [11].

Although most morphometric traits fulfilled the SNI requirements, the average body condition score (BCS) remained relatively low across all age groups. As reported in the present study, BCS reflects body condition rather than skeletal development and is more susceptible to differences in feeding management and nutritional status among farmer groups [12]. Therefore, the relatively low BCS observed in this study is likely associated with management practices rather than the structural body characteristics of the animals. Despite this condition, the satisfactory morphometric measurements indicate that the evaluated goats still possess good potential as candidate breeding stock.

4.2. Coefficient of Variation of Morphometric Traits

The coefficient of variation (CV) showed a consistent pattern in which goats in the I0 group exhibited higher variation than those in the I1 and I2 groups for most morphometric traits. According to the discussion presented in the report, this pattern indicates that environmental factors, including nutrition, feed adaptation, and management systems, have a greater influence on phenotypic expression during the early growth period, resulting in greater variation among young animals. Similar observations were reported by Mudawamah et al. [11], who found that morphometric variation decreased with age as body growth became more stable.

The relatively lower CV values observed in the I1 and I2 groups indicate that body measurements became more uniform as goats approached physiological maturity. This finding supports the recommendation of SNI 7352.1:2015 that breeding stock selection should be performed after animals have reached sufficient body development. Warmadewi et al. [13] also reported that morphometric variation in PE goats provides an opportunity for effective selection, while Rizky Zein and Rahmatullah [14] found that female PE goats aged 8–12 months showed a high level of conformity with the SNI standard, making this age suitable for breeding stock evaluation.

Among all evaluated traits, body condition score had the highest coefficient of variation. This result indicates that body condition varied considerably among individual goats, most likely due to differences in feeding management among farmer groups. In contrast, the lower variation observed in the principal morphometric traits suggests a relatively homogeneous population, supporting the use of these body measurements as reliable criteria for selecting candidate breeding stock. Overall, the morphometric conformity with SNI 7352.1:2015 and the lower variation observed in the

older age groups indicate that female PE goats in Karangasem Regency have good potential to be developed as breeding stock through morphometric-based selection.

5. Conclusion

The morphometric characteristics of female Peranakan Etawah (PE) goats in Karangasem Regency generally increased with age, indicating normal body growth and development. The average values of major morphometric traits, particularly withers height, chest girth, body length, and ear length, in the I1 (8–12 months) and I2 (>12–18 months) age groups met the minimum requirements of the Indonesian National Standard (SNI 7352.1:2015) for female breeding stock. Most morphometric traits exhibited low to moderate coefficients of variation, indicating relatively uniform body measurements, whereas body condition score showed greater variation, likely reflecting differences in feeding management among farmer groups. Overall, the evaluated female PE goats possess favorable morphometric characteristics and have the potential to be selected as candidate breeding stock to support genetic improvement programs in Karangasem Regency.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

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