



Morphometric and Phenotypic Characterization of Pote Goats in Soket Laok Village, Tragah District, Bangkalan Regency, Madura

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ABSTRACT: The purpose of this study was to analyze the morphometric characteristics of Pote goats in Soket Laok Village, Madura Island. The material used was 200 Pote goats with an age range from over 1 year (PI0>6) to more than 3.5 years (PI8). The sample included 90 goats aged over 1 year (PI0>6), 36 goats aged between 1 and 1.5 years (PI2), 54 goats aged between 1.5 and 2.5 years (PI4), 16 goats aged between 2.5 and 3.5 years (PI6), and 4 goats aged over 3.5 years (PI8). The method used is a survey method which includes conducting surveys and interviews. Data were obtained using a purposive sampling technique. The results showed that morphometric measurements on the head and body of Pote goats had the highest average at PI 8, which means that along with the increasing age of Pote goats, it will affect the body size of goats. The results of the dominant phenotypic characteristics of Pote goats are the shape of a pitcher udder, the shape of long drooping ears, the shape of flat horns, rectangular pupils, convex facial profiles, there is rews hair both in males and females and there is no beard, and phenotypic Pote goats with different ages do not have significant differences.

KEYWORDS: Pote Goat, Morphometric, Phenotypic, Local Goat, Characterization.

INTRODUCTION

Goats are considered a valuable part of Indonesia's germplasm. They are small ruminants that can be easily farmed by the community. Goats have the advantage of adapting to environmental stress, being tolerant to diseases, and withstanding hot and cold temperatures. They are also resistant to high fiber feed and have the ability to produce more than one kid per birth, making them highly productive (Liu *et al*, 2019). Goats are well-suited to Indonesia's tropical environment, making goat farming a profitable option for meeting the community's animal protein needs. According to Animal Husbandry and Animal Health Statistics (2021), the demand for meat production has been increasing every year. In the last five years, the number of goat populations has also increased, with East Java Province having the largest population of 3,763,061 heads.

The Ministry of Agriculture has identified eight local goat breeds in Indonesia. According to Pamungkas, Batubara, Doloksaribu, and Sihite (2009), the germplasm of local goats includes the Peanut Goat, Peranakan Etawa Goat, Marica Goat (South Sulawesi), Samosir Goat (Samosir Island), Muara Goat (North Banuri), Kosta Goat (Banten), Gembrong Goat (Bali), and Bengal Goat (East Nusa Tenggara). These local breeds are known as Local Livestock Genetic Resources and they play a crucial role in improving people's livelihoods and nutrition. The resilience of goats to non-ideal environmental conditions highlights the importance of developing and protecting Indonesian local goats for the benefit of the community. In Indonesia, most goats are still traditionally raised. However, both the quality and quantity of their feed are not considered, which can affect the appearance and characteristics of the goats.

Pote goat is a breed of dual-purpose goat that originates from Arosbaya sub-district, Bangkalan Regency, Madura, East Java Province. The breed has a population of 3000 and is capable of producing both meat and milk, with an average milk yield of 700-800 ml per day per goat if milked properly (Suyadi, 2022). Pote goats are able to adapt to lowlands and hot weather due to the hot weather characteristics of the Madura Island region. As a new type of goat that has not been extensively studied, morphometric and phenotypic research is necessary to fully understand their genetic potential and productivity. It is important to conduct further research on Pote goats in order to preserve national germplasm.

Characterization is an initial step in obtaining standard livestock seeds. Its purpose is to identify economically valuable traits or relevant clump characteristics (Pertiwi, 2018). This is achieved through the observation of both qualitative and quantitative traits. Quantitative traits are measurable productive and reproductive traits, while qualitative traits are described descriptively. Qualitative

characteristics refer to the external appearance of livestock, such as coat color, udder shape, ear shape, body type, body shape, fur texture, beard, face profile, back line, and eye pupil. According to Zafitra *et al.* (2020), morphometrics is the study of variations and changes in animal body size. In livestock, morphometrics can be used to describe and assess an animal's potential.

Research is needed on the morphometric and phenotypic characteristics of Pote goats in Soket Laok Village, Tragah District, Bangkalan Madura Regency. This study aims to aid in the breeding of Pote goats in Bangkalan, Madura.

MATERIALS AND METHODS

The study utilized 200 Pote goats, both male and female, with ages ranging from over 1 year (PI0>6) to more than 3.5 years (PI8). The sample included 90 goats aged over 1 year (PI0>6), 36 goats aged between 1 and 1.5 years (PI2), 54 goats aged between 1.5 and 2.5 years (PI4), 16 goats aged between 2.5 and 3.5 years (PI6), and 4 goats aged over 3.5 years (PI8).

The research method employed surveys and interviews with farmers to gather information on morphometric and phenotypic characteristics of male and female cattle aged between PI0>6 months to PI8. Purposive sampling technique was used based on age. The sampling was conducted in Soket Laok Village, Tragah Subdistrict, Bangkalan Regency, Madura. Primary data was obtained through direct observation, farmer interviews, recording, and documentation.

Morphometric data were collected by measuring Pote goats, including body length, height, front and hind leg length, tail length, chest circumference and width, ear length and width, head length and width, and horn length. Phenotypic data collection is carried out by observing data on phenotypic traits of Pote goats including udder shape, ear shape, horn shape, eye pupil, face profile, back line, rewsos and beard.

The equipment used in morphometric and phenotypic measurement research is a measuring tape with an accuracy scale of 0.1 cm and a measuring stick with an accuracy of 0.1 cm and a capacity of 115 cm, and a camera. Morphometric measurements of Pote goats are shown in Figure 1 (Pertiwi, 2018).

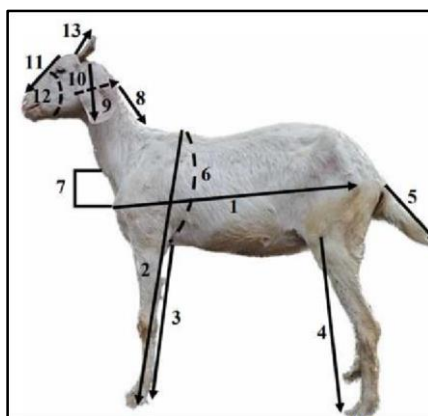


Figure 1. How to measure morphometric characteristics of pote goat quantitative traits.

Source : Personal documentation (2022)

The variables observed based on the statement of Tagoi, *et al.* (2020) in this study include:

1. Body length (cm), measured the distance between the protrusion of the shoulder (*tuberculum humerus lateralis*) to the protrusion of the sitting bone (*tuberculum ischiadicum*) using a measuring stick with a precision scale of 0.1 cm.
2. Body height (cm), measured perpendicularly from the highest point of the backbone (*vertebrae thoracalis*) to the ground behind the front foot using a measuring stick with an accuracy scale of 0.1 cm.
3. Foreleg length (cm), measured from the protruding part of the bone at the front of the chest, to the ground using a yardstick with a scale accuracy of 0.1 cm.
4. Length of hind legs (cm), measured from the tracked to the protrusion of the tapis bone using a measuring stick with a precision scale of 0.1 cm.



5. Tail length (cm), measured from the base of the tail to the tip of the tail using a measuring tape with an accuracy scale of 0.1 cm.
6. Chest circumference (cm), measured around the chest cavity behind both elbows to the shoulders using a measuring tape with an accuracy of 0.1 cm.
7. Chest width (cm), measured at the distance of the left and right shoulders using a measuring tape with an accuracy of 0.1 cm.
8. Ear length (cm), measured from the base of the ear to the tip of the ear using a measuring tape with an accuracy scale of 0.1 cm.
9. Ear width (cm), measured on the outside of the ear from the left side to the right side using a measuring tape with an accuracy scale of 0.1 cm.
10. Head length (cm), measured from the highest distance to the foremost point of the skull using a measuring tape with an accuracy scale of 0.1 cm.
11. Width of the head (cm), measured from the distance of the outermost left and right protrusion points of the skull measured using a measuring tape with an accuracy scale of 0.1 cm.
12. Horn length (cm), measured from the base of the horn to the tip of the horn measured using a measuring tape with a precision scale of 0.1 cm.

Phenotypic variables observed included :

1. Udder shape. Udder shapes are categorized into jug shapes and bottle shapes.
2. Ear shape. Ear shape is categorized into long droop and wide droop.
3. Horn shape. Horn shape is categorized into round and flat.
4. Eye pupil. Eye pupils are categorized into round, oval and rectangular shapes.
5. Face profile. Face profile is categorized into convex and flat.
6. Dorsal line. The back line is categorized into concave and straight.
7. Rewos (mane of hair). Rewos are categorized into none, short and long.
8. Beard profile. Beard profile is categorized into long, short and absent.

Data Analysis

The morphometric data obtained were entered and tabulated into Microsoft Excel and then analyzed by calculating the mean of observations, Standard Deviation (SD) and coefficient of variation (Tagoi, *et al.*, 2020):

- a. Average Observation Value

$$\bar{x} = \frac{\sum xi}{n}$$

- X = Observation value or sample mean value
∑ = Summation
Xi = The i-th observation value
n = Number of samples

- b. Standard Deviation

$$SD = \frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n - 1}$$

- SD = Standard Deviation
∑X² = Sum of squares of all data values
∑X = Sum of all data values
N = Number of data



c. Regression Coefficient

To determine the regression relationship between age and body size, the formula below is calculated:

$$Y = a + bx$$

Source: Unutio, *et al.* (2015)

Y = Age

X = Body Size

a = Constant (Y' value if X = 0)

b = Regression coefficient

d. Correlation Formula

$$r = \frac{n \sum xy - (\sum x) (\sum y)}{\sqrt{\{n \sum x^2 - (\sum x)^2\} \{n \sum y^2 - (\sum y)^2\}}}$$

Source: Unutio, *et al.* (2015)

n = number of x and y data pairs

$\sum x$ = total number of x variables

$\sum y$ = total number of y variables

$\sum x^2$ = the square of the total number of x variables

$\sum y^2$ = the square of the total number of y variables

$\sum xy$ = the product of the total number of x variables and y variables

Phenotypic data that has been obtained is entered and tabulated into Microsoft Excel which is then analyzed by calculating the percentage of each variable by calculating the frequency of phenotypes that appear. Phenotype frequency can be used to see variations in qualitative traits. Phenotype frequency is calculated based on the guidelines of Pertiwi (2018) using the following formula:

$$\text{Phenotype frequency} = \frac{\text{number of traits } x}{n} \times 100\%$$

X = one of the qualitative traits

n = number of observed data

RESULT AND DISCUSSION

Morphometric Measurements of Head Parts

Measurement begins with livestock that are over 6 months old because they have reached sexual maturity, at which point the growth rate of goats becomes constant, neither too fast nor too slow. This is in line with Purwanti *et al.*'s (2019) findings that a goat's growth rate is very rapid prior to sexual maturity, but slows down and eventually stops after reaching physical maturity, at which point body fat deposits begin to appear. **Table 2** shows the average measurements of head parts in Pote goats. The lowest average value of head length is at PI0 with 15.29 ± 2.26 cm, while the highest average value of head length is at PI 8 with 19.50 ± 1.29 cm. The head width has the lowest mean value at PI 0 with 9.1 ± 1.26 cm, while the highest mean value of head width is at PI 8 with 11.75 ± 0.96 cm. Based on the data, it is evident that as Pote goats age from one year to adulthood, they experience growth in head length and width. Goats in the age range of children to adults exhibit a wide variety of body and head shapes, providing an opportunity for selective breeding to obtain superior offspring (Nurfaizin and Matitaputty, 2017).

The ear length mean value was lowest at PI 0 with 18.07 ± 1.92 cm, and highest at PI 4 with 20.59 ± 1.93 cm. The lowest mean value of the ear width variable was 7.58 ± 0.78 cm in PI 0, while the highest mean value of ear width was 9.20 ± 1.89 cm in PI 4. It can be concluded that Pote goats experience significant growth in ear length and width from 6 months to 2 years of age. After the age of 2 years, changes in ear length and width are not significant. The length and width of the ears of Pote goats are influenced by both age and genetics. Quantitative traits in goats that are not directly observable must first be measured in units such as reproduction

and productivity. These traits are influenced by both environmental and genetic factors (Swuandana, Rahmatullah, and Sulaiman, 2022). This is consistent with Rasminati (2013) statement that livestock body growth continues to occur as goats age.

The average horn length of Pote goats ranges from The highest average value of horn length is PI 8, which measures 13.0 ± 5.35 cm. The average horn length of other goats is 3.25 ± 2.68 cm. The average horn length of Pote goats is similar to that of Kacang goats, ranging from 8-10 cm and having a sword-like shape. According to Table 1, the length of goat horns increases with age. However, field observations of 2-year-old goats reveal that their horns may break due to fights with other goats or to defend against threats, which often occur during grazing. Livestock's body size and shape will increase until reaching the optimum or adult point (Getahun, Ahmed, and Zemene, 2020). The head profile of Pote goats heard at ages PI 0 > 6, PI2, PI4, PI6 and PI8 is shown in Figure 2.

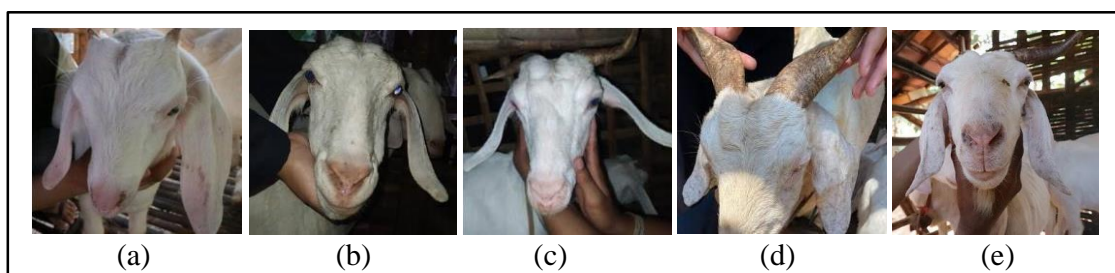


Figure 2. The head profile of Pote goats heard at ages (a) PI 0 > 6, (b) PI 2, (c) PI 4, (d) PI 6 and (e) PI8.

Source: Personal documentation (2022)

Table 2. Average Head Measurements of Pote Goats

Age	Number of goats	Average Head Measurement (cm)				
		Head Length	Head Width	Ear Length	Ear Width	Horn Length
PI 0 > 6 month	90	15,29±2,26	9,1±1,26	18,07±1,92	7,58±0,78	3,25±2,68
PI 2	36	17,93±1,81	10,46±1,20	20,40±1,43	8,69±0,73	8,25±2,66
PI 4	54	18,91±2,04	10,87±0,99	20,59±1,93	9,20±1,89	10,02±3,21
PI 6	16	19,19±1,47	10,94±0,95	19,97±1,47	8,47±0,74	10,56±4,55
PI 8	4	19,50±1,29	11,75±0,96	19,50±0,58	8,25±0,50	13,0±5,35
Total/ Average	200	18,16±1,77	10,62±1,07	19,7±1,46	8,44±0,93	9,02±3,69

Source: primary data 2022

Morphometric Measurements of Body Parts

The quantitative characteristics of measurements on the body area of Pote goats in Tragah District, Bangkalan Regency during the study are presented in Table 3. The study revealed that the smallest chest girth variable in Pote goats is at PI 0 (49.97 ± 6.41), while the highest value is at PI 8 (74.0 ± 6.27). Additionally, the circumference of the goat's chest increases with age. This variation in chest girth size can be attributed to several factors, including differences in feeding and maintenance management. Zakiya, Feby, Putri, and Yusni (2022) stated that the growth of goats in terms of quality and quantity is affected by both environmental and genetic factors. They also noted that even livestock with high genetics will only be able to produce optimally if placed in an optimal environment.

The study results indicate that PI 8 had the highest average body length of 62.25 ± 4.99 among Pote goats. Similarly, PI 8 also had the highest mean body height of 70.75 ± 3.50 . These results suggest that as the Pote goats grow older, their body length and height increase. Additionally, the growth of their height continues to change from birth to adulthood. According to Field (2017), livestock growth refers to cell enlargement, division, or weight gain until the animal reaches adulthood. This process affects the body size of the animal, which continues to increase until it reaches adulthood. Victori et al. (2016) state that the height or shoulder height of livestock indicates that the bones in their legs will continue to grow until they mature, serving as a buffer for their body.

The chest width in Pote goats shows the highest average result in PI 8 which is 17.0 ± 1.15 . The width of a goat's chest is determined by the growth of the breastbone and chest cavity, which is influenced by internal organs and the attachment of meat to the shoulder and bone. According to Victori et al. (2016), the growth of chest width in livestock is an indication of rib development in goats. Additionally, the height of the shoulder and chest in goats are strongly correlated. Foreleg length and hind leg length in Pote goats showed higher average results at PI 8 of 39.5 ± 1.91 and 44.0 ± 3.27 . According to Table 4, the front legs of the goats were shorter than their hind legs. Victori et al. (2016) noted that bone growth, particularly in the leg bones, is crucial for supporting the body of goats. According to Basbeth, Dilaga, and Purnomoadi (2015), the hind leg bones of livestock serve as a support for the body of goats, resulting in faster and earlier leg growth compared to other parts of the body. The hind legs of goats are formed by a group of bones including the os femuris which functions as a buffer as well as part of the drive in livestock. Livestock's increase in body size and shoulder height is closely related to the growth of their front leg bones. These bones grow faster than others and serve the purpose of supporting the animal's body.

The average tail length of Pote goats in PI 8 is 19.0 ± 7.35 . The length of the tail in Pote goats increases with age and is also influenced by genetics. According to Pertiwi (2018), the variation in goat tail length is a result of genetic diversity in livestock. During meiosis, genes from different chromosomes are combined, resulting in new genetic combinations in the offspring. This leads to unique genetic traits. The full body shape of Pote goats from age PI 0 > 6, PI 2, PI 4, PI 6 and PI8 is shown in **Figure 3**.

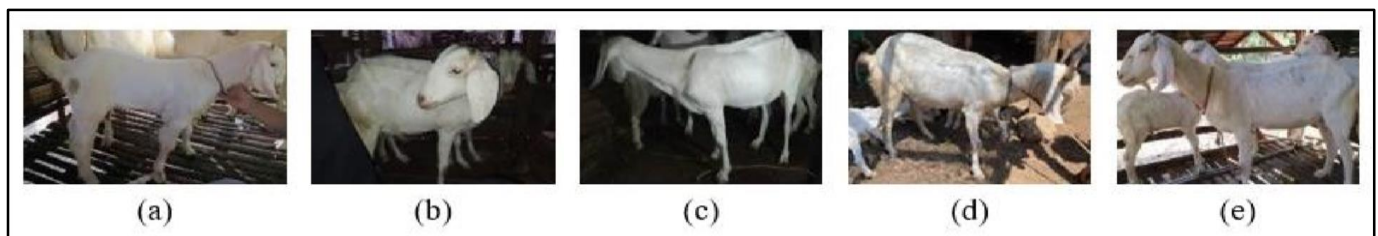


Figure 3. The body part profile of Pote goats heard at ages (a) PI 0 > 6, (b) PI 2, (c) PI 4, (d) PI 6 and (e) PI8.

Source: Personal documentation (2022)

Table 3. Average Body Measurement of Pote Goats

Age	Number of goats	Average Body Measurement (cm)							
		Chest Girth	Body Length	Body Height	Chest Width	Front Length	Leg back Length	Leg Length	Tail Length
PI 0 > 6									
month	90	49,97±6,41	43,87±5,31	51,04±6,06	12,52±2,03	32,54±3,99	36,99±3,96	14,08±2,67	
PI 2	36	65,45±6,67	55,03±6,32	64,03±4,98	14,63±1,96	36,85±2,80	43,07±2,80	17,40±2,73	
PI 4	54	68,85±5,39	57,76±4,78	65,99±5,07	15,46±2,0	38,22±3,41	43,85±3,50	17,14±2,99	
PI 6	16	70,0±5,94	60,0±3,98	67,03±2,83	16,63±2,00	37,94±3,01	42,16±3,01	16,81±1,94	
PI 8	4	74,0±6,27	62,25±4,99	70,75±3,50	17,0±1,15	39,5±1,91	44,0±3,27	19,0±7,35	
Total/ Average	200	65,65±6,14	55,78±5,08	63,77±4,49	15,25±1,83	37,01±3,24	42,01±3,31	16,89±3,54	

Source: primary data 2022

Dominant Phenotypic Characteristics in Pote Goats

The results of research on the dominant phenotypic characteristics of Pote goats are the shape of the pitcher udder, long drooping ears, flat horn shape, rectangular pupils, convex face, straight back line, reвос fur, and no beard. According to Susilorini et al. (2022), Pote goats share similarities with Senduro goats in terms of morphometric analysis, including body weight, body width, chest width, body height, and ear length. Genetic diversity plays a significant role in the phenotypic characteristics of livestock. Certain traits are common among a group or population of livestock, which distinguishes them from other populations and

determines the traits of breeds or types of livestock (protein diversity). Several factors can influence the frequency of genes in livestock, including selection, mutation, population mixing, inbreeding, outbreeding, and genetic drift or sudden changes in gene frequency (Dewanti et al., 2013). The dominant phenotypic characteristics of Pote goats based on age are presented in Table 4, and in Figure 4.

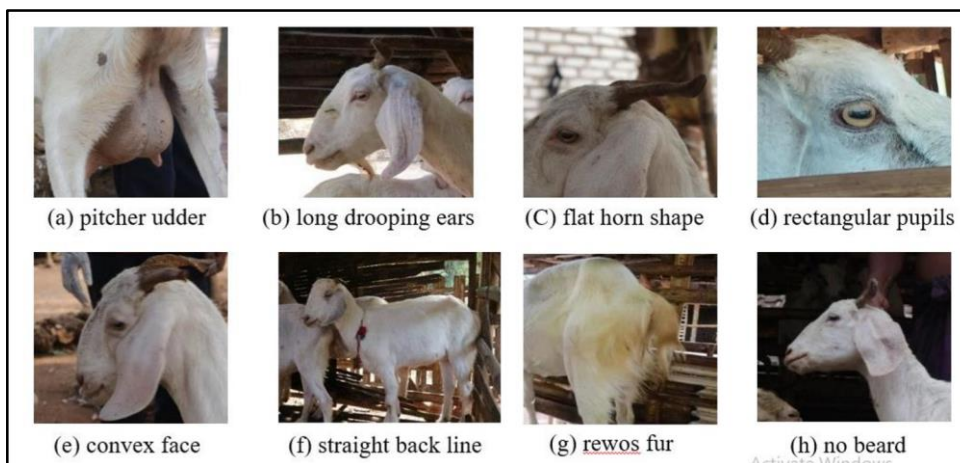


Figure 4 . The dominant phenotypic characteristics of Pote goats

Source: Personal documentation (2022)

Table 4. Dominant Phenotypic Characteristics of Pote Goats At Various Ages

Age	Ph enotypic Charac teristics							
	Udder	Ears	Horns	Eye Pupil	Face	Back	Rewos	Beard
PI 0	Pitcher	Long Drooping	Flattened	Rectangular	Convex	Straight	Available	None
PI 2	Pitcher	Long Drooping	Flattened	Rectangular	Convex	Straight	Available	None
PI 4	Pitcher	Long Drooping	Flattened	Rectangular	Convex	Straight	Available	None
PI 6	Pitcher	Long Drooping	Flattened	Rectangular	Convex	Straight	Available	None
PI 8	Pitcher	Long Drooping	Flattened	Rectangular	Convex and Flat	Straight	Available	None and Long

Source: primary data 2022

CONCLUSION

Body size in pote goats as a whole increases along with the age of pote goats. The dominant phenotypic characteristics of Pote goats are the shape of a pitcher udder, the shape of long drooping ears, the shape of flat horns, rectangular pupils, convex facial profile, there is rewos hair both in males and females and there is no beard.

ACKNOWLEDGEMENTS

We thank the breeders and the community of Soket Laok Village, Tragah Subdistrict, Bangkalan Regency, Madura, for their assistance and facilities provided during the research. As well as the support from the Faculty of Animal Husbandry, Universitas Brawijaya, which provided support during the research that was part of the Doctoral Grant (Doctor Research Grant 2022).

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Cite this Article: Nida'ul Husna Imaniah, Tri Eko Susilorini, Kuswati, Farah Adiningsih, Dina Nuraeni (2024). Morphometric and Phenotypic Characterization of Pote Goats in Soket Laok Village, Tragah District, Bangkalan Regency, Madura. International Journal of Current Science Research and Review, 7(2), 881-888