

Morphometric Characteristics of Doe Pote Goats Based on Population Structure in Bangkalan, Madura

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Abstract. This study investigated the morphometric characteristics and population structure of doe Pote goats, a local genetic resource originating from Bangkalan, Madura. Goats play an important role in traditional farming systems due to their adaptability and contribution to rural livelihoods, making the documentation of local breeds essential for conservation and development programs. A total of 253 does were evaluated using direct observation, body measurements, and interviews with goat owners. The variables analyzed included population structure as well as qualitative and quantitative traits. The population in Tragah District consisted of 62 male kids (11.27%), 107 female kids (19.45%), 32 young males (5.81%), 103 young females (18.72%), 10 bucks (1.81%), and 236 does (42.90%). The mean values of quantitative traits were: withers height 67.63 ± 4.39 cm, body length 68.71 ± 5.08 cm, chest girth 75.38 ± 5.82 cm, ear length 18.37 ± 1.88 cm, and body weight 36.30 ± 8.01 kg. Qualitative observations showed that Pote goats are predominantly characterized by a solid white coat color, relatively small body size, short pendulous ears, and straight horns. Morphometric comparisons with Kacang goats—currently the only breed with an established national standard (SNI)—indicated significant differences, confirming the distinctiveness of Pote goats. These findings highlight the potential of Pote goats as a promising local genetic resource that can be further developed and conserved to support livestock diversity and farmer welfare.

Keywords: population structure, qualitative traits, quantitative traits

1 Introduction

In Indonesia, goats are among the most widely raised small ruminants, particularly within traditional farming systems. Their advantages include the ability to utilize both forage and agricultural by-products as feed, combined with strong adaptability to diverse environmental and climatic conditions. These traits make goats a strategically important livestock commodity in supporting food security and improving rural livelihoods. According to the Livestock and Animal Health Statistics [1], the goat population in Indonesia has shown steady growth, rising from 14.37 million head in 2023 to 15.71 million head in 2024. Java

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Island accounts for the highest proportion of the national population at 67.75%, with East Java Province contributing the largest share at 34.41%.

Amid this population expansion, the genetic diversity of local goat breeds remains valuable resource that requires in-depth study to enhance productivity and ensure the sustainability of local genetic resources. One such local breed with notable potential is the Pote goat. Predominantly found in Bangkalan, Madura, this breed is distinguished by its solid white coat color, which is consistently inherited across generations. The term Pote itself comes from the Madurese word for "white." Phenotypically, Pote goats share similarities with several other breeds, including Kacang, Saanen, Etawa, and Senduro, particularly in body size, ear shape, and the presence of wattles. Kacang goats are renowned for their adaptability and ease of management [2], while Senduro goats are recognized as a superior dairy breed. The presumed genetic relationship between Pote goats and these breeds provides a crucial basis for conservation efforts and productivity improvement. To formulate effective development strategies, comprehensive baseline data on Pote goats are essential, encompassing population structure, and both qualitative and quantitative traits. This study aims to provide initial insights into the morphometric characteristics of Pote goat does in Bajeman Village, Tragah District, Bangkalan Regency—one of the core population centers of this breed. The primary data generated are expected to serve as an important reference for developing strategies to conserve and optimize the potential of Pote goats under local conditions.

2 Materials and Methods

The study was carried out from July 2 to August 15, 2024, in Tragah District, Bangkalan Regency, Madura. A total of 253 doe Pote goats were sampled based on availability and accessibility, representing approximately 46% of the local breeding population according to preliminary census data in the district. Sampling of animals was conducted using incidental sampling, while study site selection employed purposive sampling based on the initial census of breeding households in the area.

Additional information was obtained from secondary data sources, including district and subdistrict livestock records, inseminator documentation, district profiles, Central Statistics Agency (BPS) data, and other relevant publications. Research materials consisted of recording forms specifically designed to capture data relevant to goat research. The tools used included rulers, measuring tapes, recording sheets, pens, and a digital recorder.

The research methodology combined direct observation, morphometric measurements, and structured interviews with goat owners. Interviews were conducted using a questionnaire, while all physical measurements were carried out by the same researcher to maintain consistency. Collected data were systematically recorded and tabulated for further analysis. The variables observed included: (1) population structure, (2) qualitative traits, and (3) quantitative traits. Data were analyzed descriptively for population structure and traits, while correlation and regression analyses were applied to assess the relationship between chest girth and body weight.

3 Result and Discussion

3.1 Population Structure

The population structure of Pote goats in the study area was classified based on sex and age group, consisting of kids (0-12 months), young goat (1-2 years), and adults (>2 years). The distribution of Pote goats by sex and age is presented in Table 1. A total population of 551 heads was recorded, dominated by adult females (42.85%), followed by kids (30.85%) and young goats (24.50%).

Table 1. Population Structure

No	Status	Male		Female		Total	
		Total	%	Total	%	Total	%
1.	Kid	63	11.43	107	19.42	170	30.85
2.	Young	32	5.81	103	18.69	135	24.5
3.	Adult	10	1.81	236	42.85	246	44.65
Total		105	19.05	446	80.96	551	100

The high proportion of adult females indicates that farmers predominantly maintain does as the foundation of their breeding herds. This practice is consistent with traditional small ruminant production systems, where reproductive females are retained to ensure herd continuity and stable kid production. Male goat or bucks, on the other hand, are mainly kept for breeding in small numbers or marketed for meat. In contrast, the relatively low proportion of adult males (1.81%) reflects the common practice of keeping only a limited number of bucks for natural mating, while surplus males are sold at younger ages for meat. Such a population structure is considered favorable for maintaining reproductive efficiency under smallholder farming conditions.

3.2 Qualitative Characters

Qualitative characteristics are important parameters for describing the external appearance and phenotypic identity of livestock breeds. These traits, such as coat color, facial profile, horn presence, and ear shape, are relatively easy to observe and play an essential role in breed recognition, farmer preferences, and selection for breeding. In the case of Pote goats, qualitative traits also provide insights into the unique morphological markers that distinguish this local genetic resource from other Indonesian goat breeds. The distribution of qualitative characteristics of doe Pote goats observed in this study is presented in Table 2.

Qualitative traits play an essential role in breed identification and phenotypic characterization. The distribution of qualitative characteristic of doe Pote goats observed in

the study is summarized in table 2. Coat color was predominantly light with chalk white accounting for 50.20% and pale white for 48.62% of the population, while pale yellow coloration was rare (1.19%). All observed goats exhibited a plain color pattern (100%), confirming that a uniform white coat is a defining characteristics of Pote goats. This phenotypic uniformity suggest strong inheritance of coat color traits within the population and supports the recognition of Pote goats as a distinct local, genetic resource.

Table 2. Qualitative Characteristics of Doe Pote Goat

No	Characteristic	Category	PI ₂ (30)	PI ₄ (124)	PI ₆ (63)	PI ₈ (36)	Total	Percentage
1	Body color	Chalk white	14	62	34	17	127	50.20%
		Pale white	16	59	29	19	123	48.62%
		Pale yellow	0	3	0	0	3	1.19%
2	Color pattern	Plain	30	124	63	36	253	100%
		Striped	0	0	0	0	0	0
3	Facial profile	Straight	12	45	30	19	106	41.9%
		Convex	0	1	0	0	1	0.4%
		Very convex	15	70	26	13	124	49.01%
		Extra convex	3	8	7	4	22	8.7%
4	Back shape	Straight	19	63	33	10	125	49.41%
		Slanted to hump	0	36	15	8	59	23.32%
		Slanted to hip	7	1	0	7	15	5.93%
		Curved	4	24	15	11	54	21.34%
5	Beard	Present	3	23	9	6	41	16.21%
		None	27	101	54	30	212	83.79%
6	Horns	Present	30	123	63	36	252	99.60%
		None	0	1	0	0	1	0.40%
7	Ear shape	Drooping downward	21	87	46	27	181	71.54%
		Half drooping	9	37	17	9	72	28.46%
8	Ruff	Present	2	9	2	0	13	98.81%
		None	28	115	61	36	240	1.19%
9	Tail direction	Up	8	15	10	6	39	15.42%
		Down	21	106	47	27	201	79.45%
		Others	1	3	6	3	13	5.14%

Regarding facial profile, very convex profiles were most frequently observed (49.01%), followed by straight profile (41.90%), while convex and extra-convex profiles were present at much lower frequencies. This indicates moderate variation in the within the ad morphology within the population, despite overall phenotypic consistency. Backline shape also showed variability with straight backs being most common (49.41%), followed by slanted-to-hump (23.32%) and curved backs (21.34%). Such variation may reflect both genetic diversity and environmental influences, including management and nutrition. Most Pote goats did not

exhibit a beard (83.79%), indicating that this trait is not a dominant characteristic of the breed. Conversely, horns were present in nearly all individuals (99.60%), suggesting that horned goats are typical within the population. Ear shape was dominated by drooping ears (71.54%), while reminder exhibited half-drooping ears, further contributing to a relatively consistent external appearance.

The presence of a ruff or neck hair was rare observed in only 5.14% of the population, while the majority of goats (94.86%) lacked this feature. Tail orientation was predominantly downward (79.45%), with smaller proportions showing upward or other orientations. Overall, the qualitative traits indicate that goats are phenotypically homogeneous in key identifying characteristic, while still maintaining limited morphological variation in certain traits such as facial profile and backline shape. This information is important for characterization and can support future selection and conservation program. Figures 1 and 2 illustrate representative examples of the facial profile and curved back shape observed in Pote goats.



Fig. 1. Facial profile of Pote Goat



Fig. 2. Curved back shape of Pote Goat

3.3 Quantitative Characters

Quantitative traits are influenced by both genetic and environmental factors, including age, nutrition, and management. The mean body measurements of doe Pote goats across age groups are presented in Table 3.

Table 3. Quantitative Characteristics of Doe Pote Goat

Quantitative Characters	Mean Body Measurements			
	PI2 (30)	PI4 (124)	PI6 (63)	PI8 (36)
Hump height	67.34 ± 5.51	68.01 ± 4.48	68.91 ± 5.20	67.63 ± 4.39
Body length	66.40 ± 6.21	68.07 ± 5.43	69.15 ± 5.42	68.71 ± 5.08
Chest girth	72.25 ± 7.21	73.58 ± 5.72	75.07 ± 6.06	75.38 ± 5.82

Hip height	69.20 ± 6.77	69.79 ± 4.49	71.66 ± 4.35	68.99 ± 4.18
Head length	17.93 ± 1.91	17.99 ± 1.93	19.00 ± 1.89	18.21 ± 1.80
Head width	12.61 ± 1.58	12.67 ± 1.62	13.57 ± 1.59	12.88 ± 1.81
Body weight	31.37 ± 6.07	33.81 ± 6.17	35.22 ± 6.44	36.30 ± 8.01

Values are presented as mean ± standard deviation (SD). Body weight is expressed in kg; other measurements are in cm.

Body size generally increased with age, withers height reached its highest mean value at PI6 (68.91 ± 5.20 cm), while body length also peaked at PI6 (69.15 ± 5.42 cm). Chest girth continued to increase with age, attaining the highest average at PI8 (75.38 ± 5.82 cm), reflecting, ongoing body mass development in mature does. Hip height follow a similar trend with the highest value recorded at PI6 (71.66 ± 4.35 cm). Head length and width increased up to PI6 and showed a slight decline at PI8, which may be associated with growth stabilization in older animals. When compared with the Indonesian National Standard for goats (SNI 7352-2:2018) [3], Pote goats exhibited generally larger body dimensions, particularly in withers height, body length and chest girth. These differences indicate that Pote goats possess superior growth potential relative to the Kacang goat standard, suggesting their suitability as a promising local genetic resource for further development.

Comparisons with other Indonesian local goats further support the distinctiveness of Pote goats. Although Pote goats share similarities with Senduro goats, particularly in coat color [4], they exhibit distinct morphometric characteristics. Pote goats have relatively shorter ears compared to PE Singosari goats, which possess long folded ears, and Senduro goats, which are characterized by long curved ears. In addition, chest girth and body height of Pote goats also differ from those reported for PE Singosari and Senduro goats [5], indicating breed-specific morphological variation.

Correlation analysis refilled a strong and significant relationship between chest girth and body weight ($r = 0.76$; $p < 0.001$). The coefficient of determination ($R^2 = 0.58$) indicated that approximately 57.8% of the variation in body weight could be explained by chest girth. The regression equation obtained ($Y = 50.34 + 0.69X$) demonstrates that each 1 cm increase in chest girth is associated with an estimated 0.69 kg increase in body weight this results confirm that chest girth is a practical and reliable predictor of body weight in Pote goats, particularly under field conditions where weighing scale are often unavailable. Overall, the quantitative and qualitative findings collectively demonstrate that Pote goats possess distinct morphometric characteristics that differentiate them from other Indonesian goat breeds, while also highlighting their potential for selective breeding and conservation initiative.

In addition, the strong relationship between chest girth and body weight observed in this study is consistent with findings reported in other Indonesian local goats. High correlation between chest girth and body weight in Ettawa Grade goats ($r = 0.84$), indicating that chest girth is the most reliable single predictor of body weight under field conditions [6]. Similarly, chest girth exhibited the strongest correlation with body weight in adult female Kacang goats ($r = 0.81$) [7], and that the combination of chest girth and body length produced the best regression model for estimating body weight. These comparable results across different local goat breeds suggest that chest girth reflects the development of thoracic capacity, muscle

mass, and fat deposition, which collectively contribute to body weight. Therefore, the use of chest girth as an indirect selection criterion for body weight in Pote goats is scientifically justified and practically applicable, particularly in smallholder farming systems where weighing facilities are limited.

4 Conclusion

This study demonstrate that Pote goats possess distinctive qualitative and quantitative morphometric characteristics that support their recognition as a unique local genetic resource. Pote goats are phenotypically characterized by a uniform plain white coat color, predominantly drooping ears, horn presence, and limited secondary traits, indicating a relatively homogeneous population.

Body measurements of doe Pote goats generally exceed the minimum standards for Kacang goats under SNI 7352-2:2018, particularly in withers height, body length, and chest girth. The strong correlation between chest girth and body weight confirms its applicability as a practical estimator under field conditions. Overall, these findings provide essential baseline information to support conservation efforts, selective breeding programs, and future development of a specific breed standard for Pote goats.

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