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## **Selection of Superior Male and Parent Candidates for Etawa Crossbred Goats based on Breeding Values and Morphometric Characteristics in Jembrana Regency, Bali Province, Indonesia**

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### **Abstract**

The research was conducted in Jembrana Regency, Bali Province, Indonesia for five months with the aim of determining the breeding values and morphometric characteristics including shoulder height, body length, chest circumference, ear length, body weight and scrotum circumference of the Etawa crossbred (PE) goat population in Jembrana Regency, Bali. Furthermore, the research results were compared with the quantitative requirements for PE goats according to the Indonesian National Standard (SNI) 7352.1:2015, regarding Etawah crossbred goat breeds and obtained prospective superior male and parent seeds. Data were analyzed descriptively. Next, the breeding value of each individual and the morphometric

characteristics of the PE goat were calculated. The results obtained are that the highest breeding value (BV) for male goats aged I1 is livestock with code 5 and for I2 is livestock with code 5. The highest breeding value for female goats aged I1 is livestock with code 3 and for I2 is livestock with code 74. The performance of male and female goats in Jembrana Regency, Bali Province is very good, because it is higher than the minimum quantitative requirements set by SNI 7352.1:2015, regarding Etawa crossbred goat breeds. Based on this, it is recommended to use male and female PE goats, in Jembrana Regency, Bali Province, as superior male and female seeds, because they comply with the requirements of SNI 7352.1:2015, regarding PE goat breeds.

**Keywords:** Breeding Value, Morphometric Characteristics, PE Goats

### **1. Introduction**

Selection is a program that can be carried out to increase the population and genetic quality of PE goats. Through selection, it is hoped that superior livestock will be produced that have performance above the population average. Selection must be carried out in a directed, continuous manner and must not be interrupted from one generation to another.

The selection program can be carried out by looking at the morphometric characteristics of several economically valuable production traits such as: Shoulder height, body length, chest circumference, ear length, body weight and scrotum circumference, then selecting livestock that have morphometric characteristics above the population average by how to compare the results obtained with the quantitative requirements for PE goats according to the Indonesian National Standard <sup>[1]</sup> concerning Etawa crossbred goat breeds. Goats that comply with SNI can be selected as seeds, then mated with good male/female livestock, which is expected to produce superior offspring. The selection program can also be carried out by calculating the diversity coefficient (DC) and a population is said to be diverse if the Diversity Coefficient (DC) value is >15% <sup>[2]</sup>.

Apart from that, the selection program can be carried out by calculating the breeding value of the economically valuable traits of each individual and then ranking them. The magnitude of the breeding value of an animal shows the superior genetic potential that the animal has compared to the average population. Livestock that have greater breeding value will be better used as seeds or replacement livestock compared to livestock that have lower breeding value <sup>[3]</sup>. Apart from that, it depends on how many livestock will be needed as seeds or replacement livestock. According to <sup>[4]</sup>, heritability plays an important role in calculating breeding value. It is further said that reproductive traits have a low heritability value, which shows that the additive genetic variation that influences fertility is small, more influenced by environmental factors and selection based on this trait is not effective.

Selection based on breeding values and morphometric characteristics of PE goats in Jembrana Regency, Bali Province,

Indonesia has never been carried out. Therefore, this research was conducted as a basis for implementing a selection program to improve the genetic quality and population of goats.

## 2. Method

### 2.1 Time and Place

The research was carried out for five (5) months in Jembrana Regency, Bali Province, Indonesia using 168 PE tooth I0 goats; I1; and I2. The tools used in this research were a fixation cage, scales, measuring tape, notebook and pencil.

The research was carried out by directly measuring the morphometric characteristics (shoulder height, body length, chest circumference and ear length) in PE goats. Next, the data is grouped by age and gender. The independent variable used in this research is livestock age. The dependent variable is morphometric measurements which include: Shoulder height, body length, chest circumference, ear length, body weight, and scrotum circumference. Meanwhile, the control variable is livestock rearing management (the feed provided is assumed to be the same). The data obtained was analyzed descriptively. The breeding value for each individual was calculated using the individual selection method (performance test) with the formula <sup>[5]</sup>, namely:  $BV = h^2(P_i - \bar{P})$ , where  $BV$  = breeding value;  $h^2$  = heritability;  $P_i$  = individual morphometric characteristics;  $\bar{P}$  = average morphometric characteristics of the population.

### 3. Result and Discussion

The breeding values of morphometric characteristics (shoulder height, body length, chest circumference and ear length) of male Etawa crossbreed goats aged I1 are presented in Table 1. The ranking of livestock based on the results of calculating the breeding values for morphometric characteristics (shoulder height, body length, chest circumference and ear length) in male PE goats. From the measurements carried out, only the 5 highest ranking individuals were taken as potential seeds. The use of males in the population is limited for efficiency.

Based on Table 1, it can be seen that male goat code 5 is the best, because it occupies the top rank in terms of shoulder height, body length and chest circumference. Code 5 goats can be used as male candidates to improve the genetic quality of the goat population in Jembrana district. Warmadewi *et al.* <sup>[6]</sup> who found that chest circumference has a closer relationship with body weight compared to body length and shoulder height. Therefore, selection to improve the genetic quality of goats is more effective on chest circumference compared to selection on body length and shoulder height.

The breeding values for morphometric characteristics (shoulder height, body length, chest circumference and ear length) in male Etawa crossbreed goats aged I2 are presented in Table 2. Table 2 shows that the male goat with code 5 is the best, because it is superior in terms of chest circumference. This characteristic is more closely related to body weight than to shoulder height, body length and ear length. If mating is carried out, it is hoped that the offspring will have good genetic quality. According to <sup>[3]</sup> that individuals with high breeding values will demonstrate their ability to pass on their genetic potential to their offspring and the potential appearance of their parents will appear in their offspring. The higher the breeding value, the more

superior the characteristics of the livestock, along with the results of their offspring.

**Table 1:** Estimated breeding values for morphometric characteristics (shoulder height, body length, chest circumference and ear length) of male goats at age I1

No.	Code	Shoulder height (cm)	Breeding values
1.	5	82	2.62
2.	2	80	1.34
3.	8	80	1.34
4.	6	79	0.70
5.	9	79	0.70
No.	Code	Body length (cm)	Breeding values
1.	5	78	0.56
2.	8	77	0.43
3.	7	75	0.17
4.	2	74	0.04
5.	1	74	0.04
No.	Code	Chest circumference (cm)	Breeding values
1.	5	79	0.05
2.	2	76	0.02
3.	1	76	0.02
4.	6	75	0.01
5.	8	75	0.01
No.	Code	Ear length (cm)	Breeding values
1.	3	34	0.99
2.	4	34	0.99
3.	2	32	0.33
4.	8	32	0.33
5.	9	32	0.33

Female goats aged I1 with code 3 are the most superior in terms of chest circumference and body length, so good results will be obtained if selection is carried out on this animal. Apart from chest circumference, body length is an economically valuable trait, so it is taken into account when selecting livestock. Livestock that have a body length above the population average are also expected to pass on this superior trait to their offspring.

**Table 2:** Estimated breeding values for morphometric characteristics (shoulder height, body length, chest circumference and ear length) in male goats at age I2

No.	Code	Shoulder height (cm)	Breeding values
1.	3	97	2.05
2.	4	95	0.77
3.	1	93	-0.51
4.	5	93	-0.51
5.	5	91	-1.79
No.	Code	Body length (cm)	Breeding values
1.	3	89	0.47
2.	5	88	0.34
3.	1	87	0.21
4.	4	82	-0.44
5.	2	81	-0.57
No.	Code	Chest circumference (cm)	Breeding values
1.	5	96	0.02
2.	1	95	0.01
3.	4	95	0.01
4.	3	93	-0.01
5.	2	92	-0.02
No.	Code	Ear length (cm)	Breeding values
1.	2	36	0.26
2.	4	36	0.26
3.	1	35	-0.07
4.	5	35	-0.07
5.	3	34	-0.40

Morphometric characteristics (shoulder height, body length, chest circumference and ear length) of male PE goats at different ages are presented in Table 3.

**Table 3:** Morphometric characteristics (shoulder height, body length, chest circumference and ear length) of male PE goats at different ages

Morphometric characteristics (cm)	Age					
	I0		I1		I2	
	n	X	n	X	n	X
Shoulder height	13	63.73±18.37	10	77.90±2.69	4	94.00±2.58
Body length		58.27±18.91		73.70±2.41		84.75±3.86
Chest circumference		61.82±20.15		74.30±2.54		93.75±1.50
Ear length		26.09±4.99		31.00±2.49		35.25±0.96

Note:

- n = number (head)
- X = average
- ± = standard deviation

The results of research on male PE goats aged I0 showed that the average shoulder height, body length, chest circumference and ear length were: 63.73 ± 18.37 cm; 68.27±18.91 cm; 61.82±20.15 cm and 26.09±4.99 cm, respectively. Based on SNI 7352.1:2015, the quantitative requirements (shoulder height, body length, chest circumference and ear length) for male PE goats aged 8-12 months (I0) are: 60 cm; 54 cm; 60 cm; and 22 cm, respectively. Based on this, it can be said that the morphometric characteristics of male PE goats at age I0 in Jembrana district are higher compared to SNI 7352.1:2015, regarding Etawa crossbreed goat breeds.

The results of research on male PE goats aged I1 showed that the average shoulder height, body length, chest circumference and ear length were: 77.90 ± 2.69 cm; 73.70±2.41 cm; 74.30±2.54 cm and 31.00±2.49 cm, respectively. Based on Indonesian National Standard 7352.1:2015, the quantitative requirements (shoulder height, body length, chest circumference and ear length) for male PE goats aged >12-18 months (I1) are: 73 cm; 66 cm; 71 cm; and 26 cm, respectively. Based on this, it can be said that the morphometric characteristics of male PE goats at age I1 in Jembrana district are higher compared to [1].

The results of research on male PE goats aged I2 showed that the average shoulder height, body length, chest circumference and ear length were: 94.00 ± 2.58 cm; 84.75±3.86 cm; 93.75±1.50 cm; and 35.25±0.96 cm, respectively. Based on [1], the quantitative requirements (shoulder height, body length, chest circumference and ear length) for male PE goats aged >18-24 months (I2) are: 78 cm; 74 cm; 78 cm; and 30 cm, respectively. Based on this, it can be said that the morphometric characteristics of male PE goats at the age of I2 in Jembrana district are also higher compared to SNI 7352.1:2015, regarding Etawa crossbreed goat breeds.

The results obtained in this study were higher than the results of research by [7] who conducted research on PE goats in Kaligesing. However, chest circumference showed lower results than [8] who found that the chest circumference of male PE goats was 99.5 cm. The results of this study were higher for body length and shoulder height than those obtained by [8] who found that the body length and shoulder height of male PE goats were: 81 cm and 84 cm.

**Table 4:** Morphometric characteristics (shoulder height, body length, chest circumference and ear length) of female PE goats at different ages

Morphometric characteristics (cm)	Age					
	I0		I1		I2	
	n	X	n	X	n	X
Shoulder height	24	58.75±15.23	43	74.98±4.69	74	74.00±5.26
Body length		58.58±15.64		75.74±5.09		74.97±7.47
Chest circumference		55.71±15.32		78.51±7.37		78.26±7.28
Ear length		26.67±5.85		26.53±3.71		27.85±3.75

Note:

- n = number (head)
- X = average
- ± = standard deviation

Devendra [9] reported that chest circumference can provide an idea of the condition of an animal, especially for estimating its body weight. This is supported by [10] stated that chest circumference has a closer relationship with body weight than body length and shoulder height. The higher the chest circumference, the higher the animal's body weight. Body dimensions, especially chest circumference, indicate that the animal has good and fast growth [11]. Therefore, selection to improve the genetic quality of PE goats is more effective on chest circumference compared to selection on body length and shoulder height.

Based on the research results obtained, it can be said that male PE goats in Jembrana district are suitable for use as breeds. If these male PE goats are mated with superior females through natural mating or artificial insemination, it is hoped that they can improve the genetic quality of PE goats in Indonesia, especially in Bali Province, Indonesia.

The results of research on female PE goats aged I0 showed that the average shoulder height, body length, chest circumference and ear length were: 58.75 ± 15.23 cm; 58.58±15.64 cm; 55.71±15.32 cm; and 26.67±5.85 cm, respectively. Based on [1], the quantitative requirements (shoulder height, body length, chest circumference and ear length) for female PE goats aged 8-12 months (I0) are: 56 cm; 51cm; 52cm; and 22 cm, respectively. Based on this, it can be said that the morphometric characteristics of female PE goats at age I0 in Jembrana district are higher compared to [1].

The results of research on female PE goats aged I1 showed that the average shoulder height, body length, chest circumference and ear length were: 74.98 ± 4.69 cm; 75.74±5.09 cm; 78.51±7.37 cm and 26.53±3.71 cm, respectively. Based on SNI 7352.1:2015, the quantitative requirements (shoulder height, body length, chest circumference and ear length) for female PE goats aged >12-18 months (I1) are: 65 cm; 62 cm; 66 cm; and 26 cm, respectively. Based on this, it can be said that the morphometric characteristics of female PE goats at age I1 in Jembrana district are higher compared to [1].

The results of research on female PE goats aged I2 showed that the average shoulder height, body length, chest circumference and ear length were: 74.00 ± 5.26 cm; 74.97±7.47cm; 78.26±7.28 cm and 27.85±3.75 cm, respectively. Based on [1], the quantitative requirements (shoulder height, body length, chest circumference and ear length) for female PE goats aged >18-24 months (I2) are: 69 cm; 65cm; 72cm; and 26 cm, respectively. Based on this, it

can be said that the morphometric characteristics of female PE goats aged I2 in Jembrana district are also higher compared to SNI 7352.1:2015, regarding Etawa crossbreed goat breeds.

Based on the research results obtained, it can be said that female PE goats in Jembrana district are suitable for use as seeds. If these female PE goats are mated with superior males through natural mating or artificial insemination, it is hoped that they can improve the genetic quality of PE goats in Indonesia, especially in Bali Province.

#### 4. Conclusion

It can be concluded that: (i) the highest breeding value for male goats aged I1 is livestock with code 5 and for I2 is livestock with code 3, so that goats with this number are prospective superior male seeds; (ii) the highest breeding value for female goats aged I1 is livestock with code 3 and for I2 is livestock with code 74, so that goats with this code are candidates for superior female breeds; and (iii) the morphometric characteristics of male and female goats in Jembrana Regency, Bali Province, Indonesia are in the very good category, because they are higher than the minimum quantitative requirements set by the Indonesian National Standard/SNI 7352.1:2015, concerning Etawa crossbreed goat breeds.

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