Quantitative and Qualitative Characteristic of Thin and Fat Tailed Sheep

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Abstract. This study aims to determine the Quantitative and Qualitative Characteristic of Thin and Fat Tail Sheep. The study starts from August 2023 until December 2023 in PT Juara Agroniaga Sejahtera, Jepangrejo Village, Blora City District, Blora Regency. The material used in this study was 39 Thin-tailed Sheep and 28 Fat-tailed Sheep aged 1-2 years. The variables measured where Quantitative data were body height (BH), body length (BL), chest circumference (CC), body weight (BW), and Qualitative data were fur color and horn. Data were analyzed using the Pearson correlation, and regression method. The results of this study showed that the correlation between body height (BH), body length (BL), chest circumference (CC) with body weight (BW) in DET and DEG were 0.62, 0.71, 0.72, 0.27, 0.69, 0.65 respectively. The results of this study showed that the regression between body height (BH), body length (BL), chest circumference (CC) with body weight (BW) in DET and DEG were BW = -14.03 + 0.71 BH; BW = -15.45 + 0.74 BL; BW = -21.95 + 0.65 CC and BW = 8.69 + 0.33 BH; BW = -6.76 ± 0.59 BL; BW = -19.43 ± 0.65 CC respectively. The results of this study showed that the dominant wool color pattern of DET is single white, 74.36% white, 15.38% black, and 5.13% brown and DEG is single white, 67.86% white, 14.29% black, and 7.14% brown. DET was 2.56% with horn then 97.44% without horn and DEG is 100% without horn.

Keywords: thin-tailed sheep, fat-tailed sheep, characteristic, quantitative, Qualitative.

1 Introduction

Sheep are one part of small ruminant livestock that can be raised both on a small and traditional scale by lower middle-class communities, up to a large scale on modern livestock. Not only meat but also fur, skin and milk, all of this can be used for various needs in society and there are even sheep that are used as fighting sheep. Local sheep in Indonesia are native sheep that are able to adapt to tropical climates and breed throughout the year. This local sheep is characterized by a relatively small body, uniformly colored fur, a small and not long tail. The sheep population in Indonesia in 2022 will be 15,615,300 and in Central Java the

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sheep population will be 2,326,859, a decrease from 2021, namely 2,333,425 [1]. The decline in population can be caused by various possibilities, such as natural factors, namely climate and also the care carried out by breeders which may not be optimal, thereby hampering the development of sheep.

Almost 80% of the population of Thin Tailed Sheep (DET) is in West Java and Central Java, this sheep is able to live in arid areas, has a small body, with a small and thin tail, dominant white fur color, female sheep generally have no horns, and the males usually have small horns. Fat-Tailed Sheep (DEG) is also a local sheep that is often found in East Java, Madura, Sulawesi and Lombok. Its characteristic is a tail that is fat, long, wide, thick and gets smaller towards the end. This tail is used as a place to store fat (energy reserves). When there is a lot of feed, the sheep's tail is full of fat and looks enlarged. Fat-Tailed Sheep (DEG) is larger when compared to Thin-Tailed Sheep (DET). Increasing the population and quality of sheep needs to be done to address the problem of declining sheep populations in Indonesia.

To improve the quality of sheep, regulations regarding Quality Standards or the quality of the livestock seeds produced are required, based on Minister of Agriculture Regulation No. 57/Permentan/OT.160/10/2006, concerning Guidelines for Good Goat and Sheep Breeding, it is stated that to guarantee production quality in accordance with consumer demand, quality livestock seeds are needed, in accordance with the minimum technical requirements for each goat and sheep seed. This research was conducted based on conditions occurring in the field with the aim of determining productive broodstock by identifying quantitative traits with the test variables: Body Height (BH), Body Length (BL), Chest Circumference (CC), and Body Weight (BW), as well as qualitative with fur and horn color variables, in Thin Tailed Sheep (DET) and Fat-Tailed Sheep (DEG) at PT Juara Agroniaga Sejahtera.

2 Materials and Methods

2.1 Observation Object

The objects observed were sheep in the Gen Markonah breeding farm division of PT Juara Agroniaga Sejahtera with sheep aged 1-2 years, in good health and without defects.

2.2 Sample Determination Technique

The test samples were local Thin-Tailed sheep (DET) and fat-tailed sheep (DEG) which were observed directly and taken as samples in the research (Sampling Frame) with 39 Thin-Tailed Sheep (DET) and 28 Fat-Tailed Sheep (DEG).

2.3 Observation Variables

The variables observed in this study consisted of quantitative characteristics consisting of Body Height (TB), Body Length (PB), Chest Circumference (LD), and Body Weight (BB), as well as qualitative characteristics consisting of fur color and horn.

2.4 Data analysis

The methods in this research with the first two qualitative methods are traits that are generally explained with words or pictures, for example, fur or skin color, color patterns, and horned or hornless traits that can be distinguished without having to measure them [2], Qualitative traits according to [3] are usually only controlled by a pair of genes and environmental factors

have no influence. The second quantitative method is the characteristics of production and reproduction or characteristics that can be measured, the data that has been collected is analyzed using Pearson correlation, and the regression method uses Microsoft Excel, to obtain the final conclusion of the research. Correlation analysis is a method for determining whether there is a relationship between variable X and variable Y. The correlation coefficient (r) formula used according to [4] is as follows.

$$r = \frac{n(\Sigma XY)-(\Sigma X)(\Sigma Y)}{\sqrt{\{n(SX^2)-(\Sigma X)^2\}\{n(SY^2)-(\Sigma Y)^2\}}} \qquad (1)$$

Information:
r = Correlation coefficient
X = Face length and body size (body length, height and chest circumference)
Y = Body weight
n = Number of livestock

The correlation coefficient (r) is a number that indicates the strength or weakness of the relationship between variable X and variable Y. A positive correlation coefficient value means there is a correlation between 2 variables, a negative correlation coefficient value means there is no correlation between the 2 variables. Functioning to facilitate interpretation regarding the strength of the relationship between two variables, [5] provides criteria which can be seen in Table 1.

Table 1. Level of Relationship Correlation Coefficient Value

Coefficient Interval	Relationship Level
0.00-0.199	Very low/weak
0.20-0.399	Low/weak
0.40-0.599	Currently
0.60-0.799	Strong
0.80	Very strong

The correlation coefficient (r) has the condition that the r value is no more than (-1 r +1). The value r = -1 means perfect negative correlation, r = 0 means there is no correlation, and r = 1 means there is a very strong correlation. The correlation coefficient test is carried out using the t-test to test the influence between variable X and variable Y. The t-test formula is according to [6] are:

$$t = r\sqrt{\frac{n-2}{1-r^2}} \qquad (2)$$

Information:
t = Calculated t value
r = Correlation coefficient
n = Number of test animals

The magnitude of the influence of body size on female DEG and DET body weight is known from the coefficient of determination using the formula:

$$r^2 = (r)^2 \times 100\% \quad (3)$$

Information:
r^2 = Coefficient of determination
r = Correlation coefficient

The relationship between body size including chest circumference, body length and shoulder height with female DEG and DET body weight was analyzed using simple linear regression. The regression coefficient describes the magnitude of change in Y for every one unit change in X. The regression line equation can be used to predict body weight based on the body size of the sheep. General equation of simple linear regression from [6] are:

$$y = a + bXy \quad (4)$$

Information:
Y: Body weight of female fat/thin tail sheep
a : Constant/ Intercept
b : Regression coefficient
X: Body size (body length, height, chest circumference)

The percentage of deviation from the estimation of livestock body weight through the regression equation to actual body weight is calculated using the following formula [6]:

$$\%\ \text{Penyimpangan} = \frac{\text{BBdugaa} - \text{BBnyata}}{\text{BBnyata}} \text{x } 100\% \quad (5)$$

Information:
BB Estimated : Body weight using a simple linear regression line equation (kg)
Real BB : Body weight by direct weighing (kg)

Diversity Coefficient (KK) according to [6]:

$$KK = \frac{sd}{\bar{x}} x100\% \quad (6)$$

Information:
$\bar{x}$ = Installment-installment
sd = Deficient standard
KK = Diversity coefficient

Deficient standard (sd):

$$sd = \frac{\sqrt{S_i^n = 1(xi - x)^2}}{n-1} \quad (7)$$

3 Results and discussion

3.1 Thin-Tailed Sheep (DET)

3.1.1 Measurement of Body Weight (BW) and Body Size

This calculation measures body weight and body size which consists of body height (TB), body length (PB), and chest circumference (LD) can be seen in Table 2.

Table 2. Results of Quantitative DET measurements

Variable	N	Mean ± SD	CV (%)
TB	39	49.44 ± 4.20 cm	8.50
PB	39	49.56 ± 4.65 cm	9.38
LD	39	66.28 ± 5.37 cm	8.09
BB	39	21.38 ± 4.85 kg	22.71

From the measurements in table 2 that have been calculated, it is known that the average of all 39 samples, the body height of DET on this farm is 49.44 ± 4.20 cm with a coefficient of diversity of 8.50%, for body length 49.56 ± 4.65 cm with a coefficient of diversity of 9.38% and circumference chest 66.28 ± 5.37 cm with a coefficient of diversity of 8.09%, and body weight 21.38 ± 4.85 kg with a coefficient of variant of 22.71%. Body weight and body size are greatly influenced by genetic factors and also several other conditions such as the environment, cage, and the nutrition of the feed provided.

3.1.2 Calculation of the correlation between body size and body weight (BW)

The results of calculating the correlation coefficient, coefficient of determination, and regression line equation for body size (X) which consists of height, body length, and chest circumference with body weight (Y) can be seen in table 3.

Table 3. Results of measuring the correlation between body size and body weight (BW)

Variable	N	r	r^2(%)	Regression Equations
BH (Body Height)	39	0.62	38.48	BW = -14.03 ± 0.71 BH
BL (Body Length)	39	0.71	50.68	BW = -15.45 ± 0.74 BL
CC (Chest Circumference)	39	0.72	52.22	BW = -21.95 ± 0.65 CC

3.1.2.1 Correlation between Body Height (BH) and Body Weight (BW)

From Table 3 it is known that the correlation coefficient value (r) height 0.62 and coefficient of determination (r^2) 38.48% with body weight shows a strong positive correlation. This value shows that if there is an increase in height, there will be an increase in weight and conversely if there is a decrease in height, there will be a decrease in weight. These values

indicate that height can be an important part of sheep performance. Syuhada *et al*. [7] stated that the bigger and taller the livestock, the more the livestock's body weight also increases. The simple regression line equation is BB = -14.03 + 0.71 BH so every 1 cm increase in body height in DET will be directly proportional to an increase in body weight of 0.71 kg.

3.1.2.2 Correlation between Body Length (BL) and Body Weight (BW)

The test results in Table 3 show that the correlation coefficient value (r) body length 0.71 and coefficient of determination (r^2) 50.68% with body weight classified as a strong positive correlation. The correlation value with positive results indicates that every time there is an increase in body length, there will be an increase in body weight. Conversely, if there is a decrease in body length, there will be a decrease in body weight. This value indicates that body length can be an important part in contributing to the weight performance of sheep. Syuhada *et al*. [7] stated that the bigger and longer the livestock's body, the livestock's body weight also increases. The simple regression line equation BW = -15.45 + 0.74 BL, a regression coefficient of 0.74 means that every 1 cm increase in body length will be followed by an increase in body weight of 0.74 kg.

3.1.2.3 Correlation between Chest Circumference (CC) and Body Weight (BW)

Based on the test results in Table 3, the correlation coefficient value (r) Chest Circumference 0.72 and coefficient of determination (r^2) 52.22% with body weight classified as a strong positive correlation. A correlation value that has a positive value indicates that every time there is an increase in chest circumference, there will be an increase in body weight and conversely, if there is a decrease in chest circumference, there will be a decrease in body weight. This value indicates that chest circumference can be an important part in contributing to sheep's body weight performance. Syuhada *et al*. [7] stated that the bigger and wider the livestock's body, the livestock's body weight also increases. The simple regression line equation BB = -21.95 + 0.65 CC, a regression coefficient of 0.65 means that every 1 cm increase in body length will be followed by an increase in body weight of 0.65 kg.

3.1.3 Characteristics of Qualitative Traits

In testing 39 Thin-Tailed Sheep (DET), the characteristic properties from table 4 consist of 2 test parts, the first is the presence or absence of horns, with only 1 sheep having horns with a ratio of 2.56% and 38 sheep having no horns. with a ratio of 97.44%, the second is the fur color with white consisting of 29 sheep and a ratio of 74.36%, black-brown color from 1 tail and a ratio of 2.56%, brown color from 2 sheep and a ratio of 5.13%, black color from 6 sheep with a ratio 15.38%, black and brown color from 1 tail with a ratio of 2.56%.

Table 4. Qualitative Properties of DET

No	Qualitative Properties	N	Ratio (%)
1	Horn		
	● Yes	1	2.56
	● No	38	97.44
Amount		39	100
2	Wool Color		
	● White	29	74.36
	● Dark Brown	1	2.56
	● Brown	2	5.13
	● Black	6	15.38
	● Black Brown	1	2.56
Amount		39	100

3.2 Fat Tail Sheep (DEG)

3.2.1 Measurement of Body Weight (BW) and Body Size

This calculation measures body weight and body size which consists of body height (TB), body length (PB), and chest circumference (CC) can be seen in Table 5.

Table 5. Quantitative measurement results of DEG

Variable	**N**	**Mean ± SD**	**CV (%)**
BH	28	51.14 ± 3.23 cm	6.31
BL	28	54.21 ± 4.59 cm	8.47
CC	28	68.18 ± 3.89 cm	5.70
BW	28	25.34 ± 3.92 kg	15.46

From the measurements in Table 5 which have been calculated, it is known that the average height of DEG on this farm is 51.14 ± 3.23 cm with a coefficient of diversity of 6.31%, for body length 54.21 ± 4.59 cm with a coefficient of the diversity of 8.47% and chest circumference 68.18 3.89 cm with a coefficient of the diversity of 5.70%, and for body weight 25.34 ± 3.92 cm with a coefficient of diversity of 15.46%. Body weight and body size can be influenced by various factors such as genetic factors and also factors from environmental conditions, cages, and the nutrition of the feed provided.

3.2.2 Calculation of the correlation between body size and body weight (BW)

The results of calculating the correlation coefficient, coefficient of determination, and regression line equation on body size (X) which consists of height, body length, and chest circumference with body weight (Y) can be seen in Table 6.

Table 6. Results of measuring the correlation between body size and body weight (BW)

Variable	*N*	*r*	r^2(%)	Regression Equations
BH (Body Height)	28	0.27	7.20	BW = 8.69 ± 0.33 BH
BL (Body Length)	28	0.69	48.10	BW = -6.76 ± 0.59 BL
CC (Chest Circumference)	28	0.65	42.45	BW = -19.43 ± 0.65 CC

3.2.2.1 Correlation between Body Height (BH) and Body Weight (BW)

From the calculation results in Table 6 for the correlation coefficient value (r) height 0.27 and coefficient of determination (r^2) 7.20% with body weight shows a low/weak positive correlation. This value shows that if there is an increase in height there will be a weak increase in body weight and conversely if there is a decrease in height there will be a low weight loss. This value shows that body height can be a part of sheep performance. Syuhada *et al*. [7] stated that the bigger and taller the livestock, the more the livestock's body weight also increases. The simple regression line equation is BW = 8.69 ± 0.33 BH so every 1 cm increase in body height in DEG will be directly proportional to an increase in body weight of 0.33 kg.

3.2.2.2 Correlation between Body Length (BL) and Body Weight (BW)

The test results in Table 6, it shows that the correlation coefficient (r) for body length is 0.69 and the coefficient of determination (r^2) 48.10% with body weight classified as a strong positive correlation. The correlation value with positive results indicates that every time there is an increase in body length, there will be an increase in body weight. Conversely, if there is a decrease in body length, there will be a decrease in body weight. This value illustrates that body length can be an important part in contributing to the weight performance of sheep. Syuhada *et al*. [7] stated that the bigger and longer the livestock's body, the more the livestock's body weight will also increase. The simple regression line equation BW = -6.76 ± 0.59 BL, with a regression coefficient of 0.59 means that every 1 cm increase in body length will be followed by an increase in body weight of 0.59 kg.

3.2.2.3 Correlation between Chest Circumference (CC) and Body Weight (BW)

Based on the test results in Table 6, the correlation coefficient value (r) body length 0.65 and coefficient of determination (r^2) 42.45% with body weight classified as a strong positive correlation. A correlation value that has a positive value indicates that every time there is an increase in chest circumference, there will be an increase in body weight and conversely, if there is a decrease in chest circumference, there will be a decrease in body weight. This value indicates that chest circumference can be an important part of contributing to sheep's body weight performance. Syuhada *et al*. [7] stated that the bigger and wider the livestock's body, the more the livestock's body weight also increases. The simple regression line equation BW = -19.43 ± 0.65 CC, a regression coefficient of 0.65 means that every 1 cm increase in body length will be followed by an increase in body weight of 0.65 kg.

3.2.3 Characteristics of Qualitative Traits

Table 7. Qualitative Properties of DEG

No	Qualitative Properties	N	Ratio (%)
1	Horn ● Yes ● No	 0 28	 0 100
Amount		28	100
2	Wool Color ● White ● Dark Brown ● Brown ● Black	 19 3 2 4	 67.68 10.71 7.14 14.29
Amount		28	100

In testing 28 fat-tailed sheep (DEG), the characteristic properties from Table 7 consist of 2 test parts, the first is the presence or absence of horns, with 0 sheep that have horns with a ratio 0% and those that don't have horns are 28, with a ratio 100%, the second is the white fur color consisting of 19 sheep and a ratio of 67.68%, black brown from 3 sheep and a ratio of 10.71%, brown color from 2 sheep and a ratio of 7.14%, black color from 4 sheep with a ratio 14.29%.

4 Conclusion

The correlation between body height (BH), body length (BL), and chest circumference (CC) with body weight (BW) in DET and DEG was 0.62, 0.71, 0.72, 0.27, 0.69, and 0.65, respectively. The results of this study showed that the regression between body height (BH), body length (BL), and chest circumference (CC) with body weight (BW) in DET and DEG were BW = -14.03 + 0.71 BH; BW = -15.45 + 0.74 BL; BW = -21.95 + 0.65 CC and BW = 8.69 + 0.33 BH; BW = -6.76 + 0.59 BL; BW = -19.43 + 0.65 CC respectively. The results from Qualitative showed that the wool color pattern of DET is 74.36% white, 15.38% black, 5.13% brown, 2.56% dark brown also black brown, while DEG is 67.86% white, 14.29% black, and 7.14% brown, 10.71 dark brown. DET was 2.56% with horn then 97.44% without horn and DEG is 100% without horn.

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