International Journal of Scientific Research and Engineering Development-– Volume 5 Issue 4, July-August 2022

Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

Correlation between Chest and Cannon Circumference with Body Weight in Fat-tailed Sheep

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Abstract:

Body measurement is useful parameter for selection of superior genetic quality to be selected as parents.The purpose of this study was to examine the correlation between chest circumference and cannon circumference with body weight in the fat-tailed sheep. The material used were 47 tails of fat-tailed sheep. The research method used is a case study with direct measurements on samples selected through purposive sampling, including sex, age and health condition of samples. The measuring data were analyzed by correlation and simple regression. The variables measured were the results showed that there was a very significant correlation (P<0.01) between chest circumference, forward cannon circumference, and rear cannon circumference on body weight in fat-tailed sheep, with correlation coefficient values of 0.9, 0.39, and 0.5, while the value of determination coefficient is 0.81, 0.15, and 0.25.In conclusion, the correlation between chest circumference with body weight is the strongest in comparison to the forward cannon circumference and rear cannon circumference.

Keywords —body weight, cannon circumference, chest circumference, correlation

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I. INTRODUCTION

Sheep are one of the livestock that plays an important role in fulfilling meat demand in Indonesia. Along with the increasing of the population, the need for meat in Indonesia is also increasing, so it is necessary to develop livestock productivity. There are various breed of sheep, one of the sheep that are very popular and widely developed in Indonesia is the fat-tailed sheep.

Fat-tailed sheep is a type of meat sheep as it has a lot of potential which is raised as one of the national meat supply livestock. The development of fat-tailed sheep has many advantages, including: it can be carried out efficiently in a narrow area, high adaptability of sheep to various environmental conditions so that it is easy to maintain and develop.

Fat-tailed sheep are a meat type sheep, so it has the potential to be developed as one of the national meat supply livestock. Fat-tailed sheep are generally distributed in East Java with excellent adaptability to various environments, especially in dry climates {1}.

One of the fat-tailed sheep development programs that can be done is through an appropriate and targeted selection program. Some of the important selection criteria in sheep are body size, namely chest circumference and cannon circumference. These body sizes can affect body weight.

Livestock need to be selected because it plays an important role in determining the performance of their offspring. The criteria that can be used are body weight and chest circumference. Body weight

and chest circumference reflect the ability of producing,including growth and development of livestock body [2].

Cannon circumference is a parameter in quantitative trait that has a positive correlation with body weight reflecting the growth rate. The canon circumference is also strongly influenced by the sex factor in livestock [3].

Determining the selection criteria plays an important role in ensuring the accuracy of the selection. The genetic correlation between body size and body weight determines the estimate of genetic progress of the correlated character. Phenotypic correlation between chest circumference and cannon circumference to body weight needs to be done to determine the degree of relationship between these variables with body weight and develop a regression line equation model that can be used to estimate body weight based on chest circumference and cannon circumference.

II. MATERIALS AND METHODS

A. Time and Location of Research

The research was conducted from March 28 to April 8, 2022 at Nabila 04 Farm, Bumirejo Village, Dampit District, Malang Regency.

B. Materials

The material used is a female fat-tail sheep (poel 2) which amounted to 47.

C. Research Methodology

Uses a case study method and direct observation to the field of samples taken by purposive sampling technique, which is based on gender considerations, healthy sheep, not disabled, and poel 2.

D. Research Variables

Variables in this study were body weight measured using a digital scale (in kg). Chest circumference (CC) is measured using a measuring tape (in cm) by encircling the chest cavity just behind the shoulder joint. Forward cannon circumference (FCC) was measured using a measuring tape (in cm) by circling the middle of the fore leg bone (*metacarpa*l). Rear cannon circumference (RCC) was measured using a tape measure (in cm) by circling the middle of the hind leg bone (*metatarsal*).

E. Data Analysis

Correlation is measured by the correlation coefficient formula is as follows [4]:

$$\mathbf{r} = \frac{\mathbf{cov_{xy}}}{\boldsymbol{\sigma_x \cdot \sigma_y}}$$

Description :

r : correlation coefficient
cov_{xy} :covarianceof x and y variable
σ_x : deviation standard (x variable)
σ_y : deviation standard (y variable)

The correlation coefficient test is conducted by T-test to determine whether the resulting correlation is significantly different, very significantly different or not significantly different. The T-test formula is as follows :

$$\boldsymbol{t = r\sqrt{\frac{n-2}{1-r^2}}}$$

Description :

t : arithmetic value
r : correlation coefficient
n : sample count

If the correlation value is significant or very significant, then it is pursued with a simple linear regression analysis with the regression right equation y = a + bx. The value of the regression coefficient (b) is calculated by the formula:

$$\mathbf{b_{yx}} = \frac{\mathbf{Cov_{xy}}}{\boldsymbol{\sigma_x^2}}$$

Description :

b : regression coefficient
Cov_{xy} : covariance x and y variable
σ_x^2 : variance of independent variable

After the value of b is known, then the value of constant (a) is calculated using the linear regression equation formula as follows:

$$\overline{Y} = a + b\overline{X}$$

Description :
y : dependent variable (body weight)
x : independent variable (chest and cannon circumference)
a : intercept
b : regression coefficient

III. RESULT AND DISCUSSION

A. Body Weight and Body Size in Fat-tailed Sheep

The mean and coefficient of variation of chest circumference (CC), forward cannon circumference (FCC), rear cannon circumference (RCC), and body weight (BW) are presented in **Table 1** below :

Table 1. The mean and coefficient of variation of BW, CC, FCC, and RCC in fat-tailed sheep.

Criteria	Total	Mean	Coefficient of Variance (%)
BW	47	27.33 ± 2,43	8.89
CC	47	74.84 ± 3,12	4.17
FCC	47	6.35 ± 0,39	6.14
RCC	47	7.51 ± 0,5	6.65

Table 1 shows that body weight has the highest coefficient of variation (8.89%) than those of chest circumference, forward cannon circumference, and rear cannon circumference (4.17%, 6.14%, and 6.65% respectively). This value indicates that sheep have more variation in body weight compare to the variation of chest circumference, forward cannon circumference, and rear cannon circumference. The coefficient of variance shows how far the spread of the data from the average value. The greater the value of the coefficient of variance, the further the scattered data from the average value. The more differences in body weight was due to the complex factors that influenced the growth of sheep.

Differences in growth included in the measurement of body dimensions of livestock are influenced by two factors, including internal factors such as age, genetics, and external factors including feed and environment [5].

B. Correlation of Chest Circumference with Body Weight

The correlation between chest circumference with body weight is presented in **Table 2.**

Table 2. Correlation coefficient between chest circumference with body weight in fat-tailed sheep.

r	R^2	P	Linier Regression Equation
0.90	0.81	P<0.01	Y = -25.23 + 0.70X

The results of the correlation coefficient analysis between chest circumference with body weightshowed a very strong and positive relationship with values of 0.90. The value of the coefficient of determination indicates that chest circumference affects body weight by 81% in the group. Based on the results of this analysis, it can be stated that chest circumference plays a very large role in estimating the body weight.

Chest circumference can also be said to be one of the markers of body weight in ruminants because it describes the body of the animal as cylindrical so that by measuring the chest circumference it can represent the body volume of the sheep being measured. In addition, the measurement of chest circumference is easier to do compared to the other body measurements [6].

The results of the simple regression analysis in **Table 2** show that the equation of the regression line in the group is Y = -25.22 + 0.70X. Regression coefficients of 0.70 illustrates that every 1 cm increase in chest circumference will have an impact on body weight gain of 0.70 kg for the group.

Sheep in Turkey showed a body size that has a positive correlation with body weight is chest circumference. The study also showed that the use of chest, hip height, cannon bone circumference, chest width, body length, and chest circumference was more accurate in estimating body weight [7].

C. Correlation of Forward Cannon Circumference with Body Weight

The correlation between forward cannon circumference with body weight is presented in **Table 3**.

Table 3. Correlation coefficient between forward cannon circumference with body weight in fat-tailed sheep.

r	R^2	P	Linear Regression Equation
0.39	0.15	P<0.01	Y = 11.92 + 2.43X

The results of the correlation coefficient analysis between forward cannon circumference with body weight showed a low positive relationship with values of 0.39. The value of the coefficient of determination indicates that the forward cannon circumference has an effect on body weight of 15%.

Based on simple regression analysis in **Table 3** shows that the equation of the regression line is Y = 11.92 + 2.43X. The regression coefficients of 2.43 illustrate that every 1 cm increases in the forward cannon circumference will have an impact on an increase in body weight of 2.43 kg.

D. Rear Cannon Circumference Correlation with Body Weight

The correlation between rear cannon circumference with body weight is presented in **Table 4**.

Table 4. Correlation coefficient between rear cannon circumference with body weight in fat-tailed sheep.

r	R^2	P	Linear Regression Equation
0.50	0.25	P<0.01	Y = 9.08 + 2.43X

The correlation coefficient between rear cannon circumference with body weight in group shows a medium relationship with values of 0.50. The value of the coefficient of determination indicates that the rear cannon circumference has an effect on body weight of 25%. The results of the coefficient of determination indicate that the rear cannon circumference has an influential role in growth. In this study, the rear cannon circumference shows larger effect than the forward cannon circumference in sheep. This result is in accordance to the research in meat-type Garut sheep that reported that the rear cannon circumference is larger than the forward cannon circumference [8].

The simple regression analysis in **Table 4** shows that the regression line equations is Y = 9.08 + 2.43X. The regression coefficients of 2.43 illustrate that every 1 cm increases in the rear cannon circumference will have an impact on an increase in body weight of 2.43 kg.

Based on the analyses showed that the chest circumference has the highest correlation and give the highest effect on the body weight in fat-tailed sheep.

IV. CONCLUSIONS

The correlation between chest circumference with body weight has the strongest relationship compared to forward cannon circumference and rear cannon circumference.

ACKNOWLEDGMENT

Author would like to thank the WCU (World Class University) UniversitasBrawijaya for the financial support to accomplish this research.

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