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Correlation and Regression Analysis of Body Weight, Scrotal Circumference, and Semen Volume in Thin-tailed Rams at the Teaching Farm University of Lampung

(Analisis Korelasi dan Regresi antara Bobot Badan, Lingkar Skrotum dan Volume Semen Domba Ekor Tipis di *Teaching Farm* Universitas Lampung)

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ABSTRAK

Kualitas Domba Ekor Tipis jantan dapat diketahui dari performa produktivitas berupa bobot badan dan kualitas reproduksi berupa lingkar skrotum dan volume semen yang merupakan indikator kualitas reproduksi untuk keberhasilan fertilisasi. Penelitian ini menganalisis korelasi dan regresi antara bobot badan (BB), lingkar skrotum (LS), dan volume semen (VS) pada sepuluh ekor Domba Ekor Tipis jantan (Ovis aries) berumur 8–18 bulan di *Teaching Farm*, Jurusan Peternakan, Fakultas Pertanian, Universitas Lampung. Metode purposive sampling digunakan untuk memilih hewan percobaan. Pengukuran BB (kg) dilakukan sebelum pemberian pakan pagi, LS (cm) diperoleh dari rerata dua kali pengukuran, dan koleksi VS (ml) menggunakan vagina buatan. Setiap parameter diukur sebanyak tiga kali dengan selang waktu empat hari, menghasilkan total 30 data (n=30). Data dianalisis menggunakan perangkat lunak R dengan uji korelasi Pearson untuk menentukan kekuatan dan arah hubungan antarvariabel, serta regresi linear untuk memodelkan hubungan prediktif antara: (1) BB dan LS, (2) BB dan VS, dan (3) LS dan VS. Hasil penelitian menyajikan korelasi positif kuat antara BB dan LS (r = 0,623; Y = 17,689 + 0,242X), korelasi positif sedang antara BB dan VS (r = 0,505; Y = -0,153 + 0,056X), serta korelasi positif sedang antara LS dan VS (r = 0,406; Y = 21,010 + 1,428X). Kesimpulan penelitian ini menunjukkan bahwa bobot badan dan lingkar skrotum dapat digunakan sebagai indikator fenotipik untuk memprediksi volume semen, sehingga dapat menjadi kriteria praktis dalam seleksi Domba Ekor Tipis jantan unggul.

Kata Kunci : bobot badan; domba ekor tipis; korelasi regresi; lingkar skrotum; volume semen

INTRODUCTION

The Thin-Tailed Ram (*Ovis aries*) is a type of sheep that is generally domesticated in Indonesia to meet the demand for meat and support the increase contribution of the livestock sector. The sheep population in Indonesia in 2022 was 15,615,300 heads, with a total national meat production of 54,650.5 tons (Badan Pusat Statistik, 2023). According to data OECD/FAO (2021) the consumption of lamb meat in Indonesia was recorded at 0.4 kg per capita, below the world average of 1.3 kg per capita, but the need for lamb meat consumption remains an important matter as a source of animal protein, even though it is a small part of the demand for the meat market global (OECD/FAO, 2023).

Sheep (*Ovis aries*) is a domestic livestock with its taxonomic classification Genus *Ovis*; dan Species *Aries* (Integrated Taxonomic Information System, 2023). According to Sumantri et al. (2007) that in Indonesia there are three breeds of sheep that have high morphological diversity, namely the Thin-tailed Sheep, Garut Sheep, and Fat-tailed Sheep.

The productivity of the thin-tailed sheep as a ram could be seen from its production performance and reproductive potential. Production potential could be seen from body weight, while reproductive potential could be known from scrotal circumference and semen volume. Based on research Syamyono et al. (2014) that scrotal circumference could be used as a parameter for buck selection. Scrotal circumference had a positive relationship with body weight and was closely related to the potential for buck semen production. Research by Syamyono et al. (2014) in Kejobong goats it was found that body weight was positively correlated with scrotal circumference. According to Qadarsina et al. (2019), Simeulue buffalo testicular size correlates with body weight according to increasing age up to a certain age. Advancing age in buffalo is associated with an increase in scrotal circumference, which progressively enlarges and reaches its optimal dimensions at a specific stage of sexual maturity. Research result of Saputra et al. (2017) stated that the greater the scrotal circumference in Bali bulls, it would be followed by an increase in the amount of semen volume with a positive correlation (0.63). Koyuncu et al. (2005) reported that in young Kivircik ram there was a very significant correlation between body weight and age with testicular size. Knights et al. (1984) stated that the size of the testicles correlated with body weight in accordance with an increase in age,

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up to a certain physiological threshold, is positively associated with the enlargement of scrotal circumference in livestock. Scrotal circumference tends to increase progressively with age and reaches its maximal size upon attaining sexual maturity.

This study investigated the correlations and regression relationships among body weight, scrotal circumference, and semen volume of Thin-tailed Ram (*Ovis aries*) at the Teaching Farm, Department of Animal Husbandry, Faculty of Agriculture, University of Lampung as practical criteria for the selection of superior Thin-tailed rams in breeding programs.

MATERIALS AND METHODS

This research was conducted in July 2023 using ten heads Thin-tailed rams aged 8-18 months, and basal feed from the Yufeed Berkah Mulia Cooperative, in the form of corn silage and concentrate with proximate analysis of crude protein 17.76% and crude fiber 12.59%. The equipment used in this study were digital hanging scales 3A Scale® type DLE-75 (75 kg±20 grams), 2.5-meter Rondo® measuring tape, artificial vagina Kruuse®, feed barrels (150 kg capacity), 10 units of 10 mL scale tube, and sterile disposable latex gloves. The variables measured in this study included body weight (kg), scrotal circumference (cm), and semen volume (ml).

This sample determination technique used a purposive sampling method. The research procedures were carried out as follows: a) preparation of individual cages, including sanitation and disinfection, places for feeding and drinking; b) Ration preparation was done by calculating the feed content to be used and providing a ration of 4% of daily body weight (kg) and were given twice a day at 07.00 a.m. and 04.00 p.m.; c) drinking water is provided *ad libitum*; d) determination of the age of rams by looking at the change of incisors; e) Weighing the body weight of each rams were done in the morning using a digital hanging scale 3A Scale type DLE-75 before the animals were given feed; f) Measurement of scrotal circumference using a 2.5-meter Rondo® measuring tape was carried out in two repetitions by measuring the widest part of the scrotal in the normal standing position; g) Semen collection used artificial vagina Kruuse® with a diameter of 41 mm and a length of 150 mm to measure semen volume; h) Measure the volume of semen by holding it in a scale tube in an upright position and looking at the total volume according to the numbers printed

on the tube wall; and i) Data collection were carried out 3 times every 4 days, total 30 data were obtained (n=30).

Data were analyzed using the R statistical software (Dakhlan, 2019; R Core Team, 2023) to evaluate the strength of associations through Pearson correlation coefficients and to develop simple linear regression models describing the relationships between: (a) body weight and scrotal circumference, (b) body weight and semen volume, and (c) scrotal circumference and semen volume. Pearson correlation analysis was employed to assess the magnitude and statistical significance of the relationships among these variables.

RESULTS AND DISCUSSION

Body Weight, Scrotal Circumference, and Semen Volume of Thin-tailed Ram

The results for body weight (BW), scrotal circumference (SC), and semen volume (SV) are presented in Table 1 and Figure 1. The mean body weight of Thin-tailed rams was 19.09 ± 3.57 kg, with a median of 19.03 kg. The body weight ranged from a minimum of 12.98 kg to a maximum of 26.44 kg, indicating substantial variation among individuals. This variability is likely attributable to differences in age, as the animals ranged from 8 to 18 months old. The average body weight observed in this study (Table 1) aligns with the findings of Maulana & Baliarti (2021), who reported that adult Thin-tailed rams typically weight between 15 and 20 kg. Furthermore, the mean body weight in this study was higher than the values by Depison et al. (2021) for the same breed.

Table 1 showed the average scrotal circumference of thin-tailed ram (*Ovis aries*) aged 8–18 months of 22.31±1.39 cm. According to Qadarsina et al. (2019), testicular size correlates with body weight according to increasing age up to a certain age. The increasing age of livestock affected the increase in the size of the SC. Scrotal circumference increases progressively with age and attains its optimal size upon reaching a specific stage of sexual maturity. The semen volume of the thin-tailed rams in this study was 0.91±0.39 ml (Table 1) more than research of Novita et al. (2020) 0.83±0.38 ml and Nubatonis et al. (2022) 0.85±0.09 ml. Research of Islam et al. (2017) and Sharmin et al. (2022) stated that increasing age would affect the increase in BS, SC, and SV of rams; the older the ram, the heavier the BW, so as to increase the SC and the SV

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produced. Figure 1 presented a boxplot for the distribution of data on BW, SC, and SV of Thin-tailed ram (*Ovis aries*).

Table 1. Body weight, scrotal circumference, and semen volume of Thin-tailed rams

Variable	Mean±SD (n=30)	Coefficient of variation (%)	Minimum	Maximum
Body Weight (kg)	19.09±3.57	12.72	12.98	26.44
Scrotal Circumference (cm)	22.31±1.39	1.93	19.00	25.50
Semen Volume (ml)	0.91±0.40	0.16	0.30	2.30

The results showed that the average SV of Thin-tailed rams of 0.91 ± 0.40 ml were within the normal range. This was in accordance with several research results that indicated the normal range of ram semen volume according to Hafez (2000) 0.2–1.2 ml; Garner & Hafez (2000) 0.8–1.5 ml; Islam et al. (2017) 0.35-1.15 ml; Novita et al. (2020) 0.83–1.05 ml. These results indicated that the Thin-tailed rams produced a standardized volume of semen even higher than that of the study Hernaman et al. (2014) 0.40–0.73 ml, Asaduzzaman et al. (2021) 0.77±0.04 ml; Setiadi et al. (2022) 0.71–0.82 ml; Sihombing (2022) 0.81±0.12 ml; dan Barbas et al. (2023) 0.77 ml.

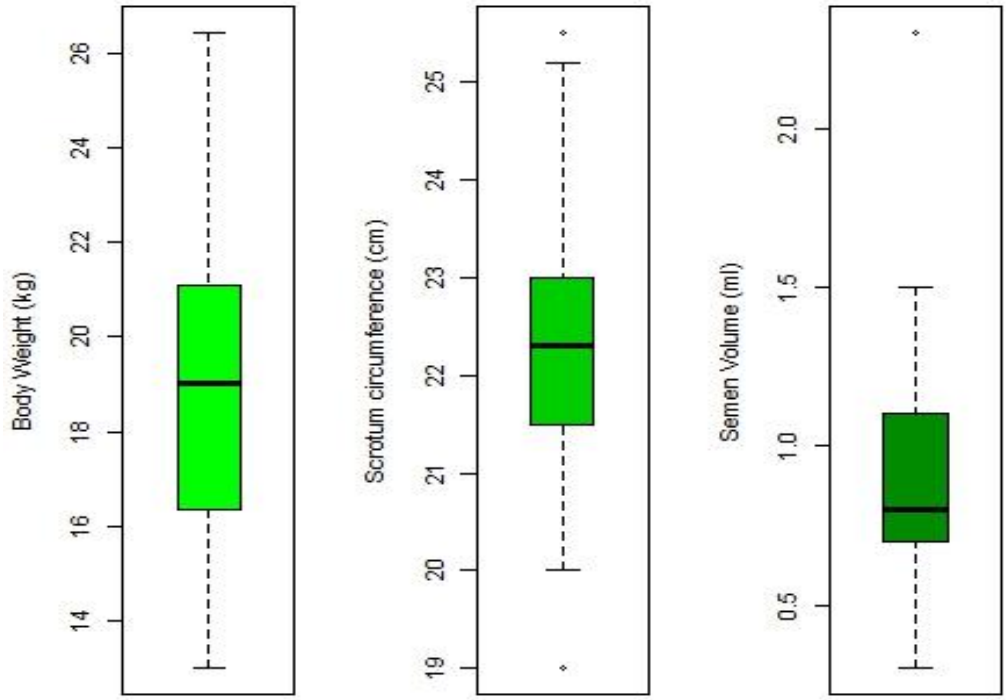

Figure 1. Boxplot distribution of data on body weight, scrotal circumference, and semen volume of Thin-tailed Rams

Correlation and Regression Between Variables

The correlation between research variables was illustrated in Figure 2, it could be seen that the variables studied had a positive and significant correlation (P<0.05) with the highest correlation value, namely between BW and SC (0.62), followed by BW and SV (0.51), and between SC and SV (0.41).

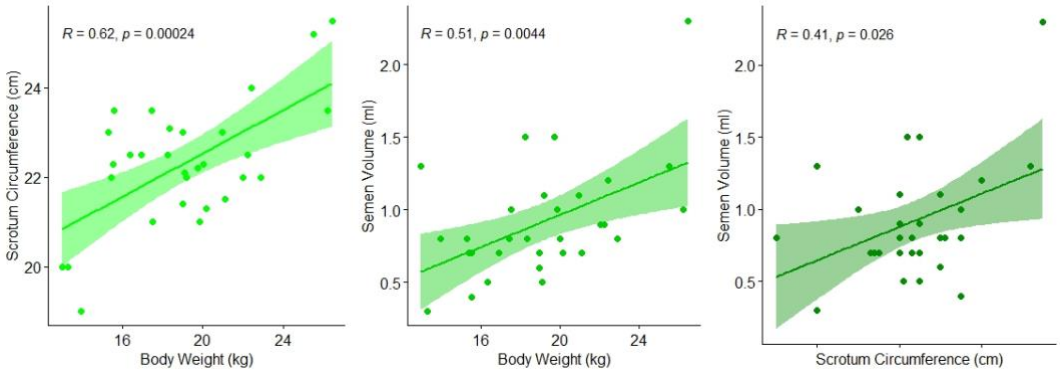

Figure 2. Visualization of the correlation between research variables

Correlation between Body Weight and Scrotal Circumference

Figure 3 displays the scatter plot and linear regression model illustrating the relationship between BW and SC in Thin-tailed rams. The analysis revealed a significant positive correlation between these variables, with a correlation coefficient of r = 0.623 (P<0.05), indicating that increases in BW was associated with corresponding increases in scrotal circumference. This suggests that heavier Thin-tailed rams tend to exhibit larger scrotal dimensions. The correlation value was included in the strong category, according to the opinion Sugiyono (2022) which states that the correlation coefficient interval of 0.600–0.799 was included in the strong category.

The value of the correlation coefficient between BW and SC in this study (0.623) was lower than Koyuncu et al. (2005) 0.845 and Sharmin et al. (2022) 0.797. This difference might be due to differences in race and age among the rams. On research Koyuncu et al. (2005) using Kivircik rams and Sharmin et al. (2022) using indigenous Bangladeshi rams. According to Koyuncu et al. (2005) and Sharmin et al. (2022) that the older the ram, the greater the circumference of the scrotal. As stated by Islam et al. (2017) of the eight rams age groups ranging from 169–200 days to 38–410 days, the oldest ram group (381–400 days) had the highest scrotal circumference (19.10±0.30 cm) compared to the youngest ram (17.16±0.05 cm).

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The relationship between BW and SC in Thin-tailed rams could be expressed through a linear regression equation. The results of the regression analysis indicated that BW (X) serves as a significant predictor of SC (Y) in this breed, the regression equation line was Y = 17.68937+0.24223X with a coefficient of determination R^2= 0.388 (Figure 3). The coefficient of determination value of 0.388 indicated that the SC variation of Thin-tailed rams was 38.8% influenced by BW and 61.2% by other factors. According to Koyuncu et al. (2005) that the age and BW of Kivircik rams were positively correlated with SC (R^2 = 0.713), so that measurement of scrotal circumference could be used as an initial selection criterion for rams, in line with Islam et al. (2017) that the oldest rams group (381–410 days) had the highest BW (13.62+1.48 kg) and the largest SC (19.10±0.30 cm) compared to the younger rams group (P<0.05).

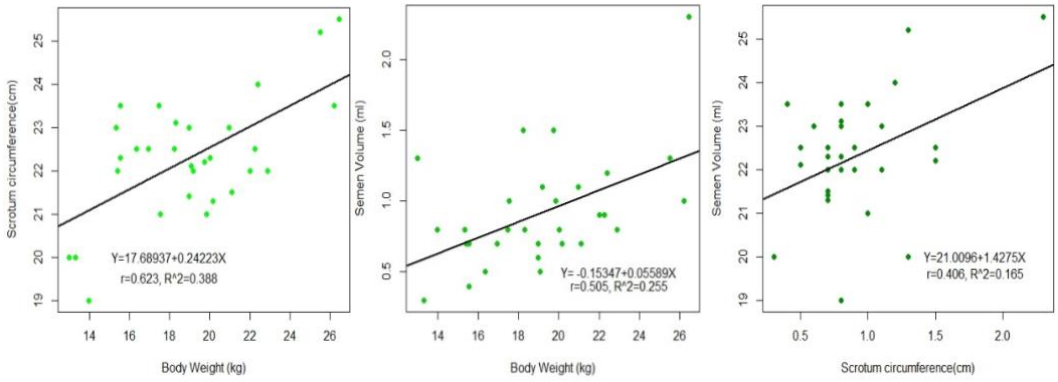

Figure 3. Scatter plot and regression equation between body weight and scrotal circumference, body weight and semen volume, scrotal circumference and semen volume of Thin-Tailed Rams

Correlation between Body Weight and Semen Volume

Figure 3 illustrates the scatter plot and regression equation describing the relationship between BW and SV in Thin-tailed rams. The analysis showed a significant positive correlation between BW and SV, with a correlation coefficient of r = 0.505 (P<0.05), was indicate that an increase in BW was associated with an increase in SV, suggesting that heavier rams tend to produce greater semen output. The value of the correlation coefficient was in accordance with the opinion Sugiyono (2022) which stated that the correlation coefficient interval of 0.400–0.599 was included in the medium category.

The regression analysis results indicated that between BW (X) and SV (Y) of Thin-tailed rams with regression equation line was Y = -0.15347 + 0.05589X with a coefficient of determination R^2 = 0.255 (Figure 3). The variation in SV

of Thin-tailed rams was 25.5% influenced by BW and 74.5% influenced by other factors. The results of this study have a correlation coefficient value between BW and SV that was 0.505 higher than the research Sharmin et al. (2022) was 0,193. According to Sharmin et al. (2022) that the increase in BW of the sheep was positively correlated with the increase in the amount of SV, in line with the increasing age of the rams. Increasing the age of rams in the study positively correlated with increasing BW with a correlation coefficient value of 0.368, so increasing the BW of ram would increase the SV produced. This was in line with research of that the age of the ram in the oldest group (381-410 days) produced the most volume of semen (1.15±0.26 ml) compared to the younger ram group ($P<0.05$). The increase in BW greatly affected the size of the testes and plasma seminal fluid, so that SV would increase.

Correlation and Regression of Scrotal Circumference and Semen Volume

Based on the results of the study, there was a significant positive correlation between SC and SV in thin-tailed rams, as indicated by a correlation coefficient of 0.406 ($P<0.05$). The correlation value was included in the moderate category, which is in according to Sugiyono (2022) which states that the correlation coefficient interval of 0.400–0.599 is included in the medium category. This is in accordance with the opinion of Sharmin et al. (2022) that SC and SV have a significant positive correlation with a correlation coefficient of 0.265. This result showed that the larger the size of the scrotal, the higher the volume of semen produced (Figure 3).

The regression analysis results showed the regression equation line was obtained between SC (X) and SV (Y), namely $Y = 21.0096 + 1.4275X$ with a coefficient of determination $R^2 = 0.165$ (Figure 3), which means that SC affects the volume of semen by 16.5%. Based on research of Islam et al. (2017) that the increase in SV is in line with increasing age, as stated by Koyuncu et al. (2005) and Sharmin et al. (2022) that increasing the age of the sheep will increase SC, so that SV produced will also increase. An increase in the size of SC is associated with an increase in testicular diameter and testicular length, as stated by Koyuncu et al. (2005) that SC was positively correlated with testicular diameter and testicular length, with correlation coefficient values of 0.889 and 0.882, respectively.

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CONCLUSION

The conclusions of this study indicate that both body weight and scrotal circumference can be used as phenotypic indicators to predict semen volume, offering practical criteria for the selection of superior Thin-tailed rams.

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