
Correlation of Morphometric Traits and BCS with Body Weight in Timor Deer.

Filandika Chorisyatun Nisa¹, Gatot Ciptadi², Ardyah Ramadhina Irsanti Putri²

¹Student at the Faculty of Animal Science, Brawijaya University, Malang

²Lecturer at the Faculty of Animal Science, Brawijaya University, Malang

*Email: ardyah.putri@ub.ac.id

ABSTRACT

*This study aimed to analyze the relationship between morphometric traits and body condition score with body weight in adult Timor deer (*Cervus timorensis*) at the Jatilengger Deer Captive Breeding, Blitar Regency. The research used a quantitative approach with descriptive and correlational methods involving 47 healthy adult deer, consisting of males and females, observed directly in the field. The measured variables were body length, body height, chest girth, body weight, and body condition score. Data were analyzed using descriptive statistics, correlation analysis, and simple linear regression. The results showed that adult male deer had an average body length of 78.7 centimeters, body height of 75.0 centimeters, chest girth of 92.7 centimeters, body weight of 77.4 kilograms, and body condition score of 3.12, indicating an ideal body form. Adult females had smaller measurements, with averages of 66.5 centimeters for body length, 62.4 centimeters for body height, 70.5 centimeters for chest girth, 45.2 kilograms for body weight, and 2.5 for body condition score, reflecting a moderate physical condition. Statistical analysis indicated a significant relationship between morphometric traits and body condition score with body weight, with chest girth showing the strongest influence. These findings suggest that chest girth can be used as a reliable predictor for estimating body weight in Timor deer, while body condition score provides useful information about the nutritional and physiological condition of the animals.*

Keywords: *Timor deer, morphometric traits, body condition score, body weight, correlation.*

INTRODUCTION

Timor deer (*Cervus timorensis*) is one of Indonesia's endemic cervid species with significant ecological and economic value. Its population has declined due to habitat degradation, illegal hunting, and land conversion, which threaten its survival in the wild (Setiyono et al., 2018; Nafiu et al., 2020). To support population sustainability, captive breeding programs play an essential role as part of ex-situ conservation efforts. One of the active breeding centers in East Java is the Jatilengger Deer Captive Breeding located in Blitar Regency, which aims to maintain and reproduce healthy and genetically valuable individuals.

Effective management of deer populations in captivity requires accurate data on body characteristics and physiological condition. Morphometric traits, including body length, height, and chest girth, are widely used to assess physical development and growth performance (Kleinlugtenbelt et al., 2021). Meanwhile, Body Condition Score (BCS) serves as a practical visual indicator of energy reserves, nutritional balance, and overall health status (Maha et al., 2021). These parameters are interrelated and contribute to determining reproductive readiness and productivity, especially under controlled feeding and management systems.

However, previous studies have focused mainly on either morphometric or BCS evaluation, leaving a research gap regarding their integrated relationship with body weight in *Cervus timorensis*. This study supports previous research while expanding the scope by analyzing both morphometric traits and BCS together as predictors of body weight in adult Timor deer. The findings are expected to provide scientific references for improving management, feeding strategies, and selection of breeding stock in captive populations. The main objective of this study is to analyze the correlation between morphometric traits and BCS with body weight in adult Timor deer maintained at the Jatilengger Captive Breeding, Blitar Regency.

METHOD

This research employed a survey method with descriptive and correlational design. The study was conducted at the Jatilengger Deer Captive Breeding, Blitar Regency, East Java, in August-September 2025. A total of 47 adult Timor deer (both males and females) were used as observation subjects. Adult individuals were identified based on the completeness of permanent incisors, indicating an age of ≥ 2.5 years.

The variables measured included body length (BL), body height (BH), chest girth (CG), body weight (BW), and Body Condition Score (BCS). Morphometric data were obtained using a flexible measuring tape (cm), and BW was recorded using a digital hanging scale (kg). The BCS was evaluated visually and by palpation on the tail base, ribs, and spine, using a 1–5 scoring scale (1 = very thin; 5 = very fat).

Data analysis included descriptive statistics (mean \pm SD) to describe morphometric and physiological traits. The Shapiro–Wilk test was applied to assess data normality due to its suitability for small sample sizes (<50). Pearson’s correlation test was used to analyze the relationship between continuous variables (BL, BH, CG, BW), while Spearman’s correlation was applied for ordinal data (BCS). The correlation strength was interpreted according to Hastono (2022): 0.00–0.25 (very weak), 0.26–0.50 (moderate), 0.51–0.75 (strong), and >0.75 (very strong). Simple linear regression analysis was performed to determine the predictive effect of each variable on body weight.

RESULT AND DISCUSSION

This section presents the results obtained from the conducted study, highlighting key findings derived from statistical analyses and empirical observations. The data are organized to address the research objectives and hypotheses, providing a foundation for subsequent interpretation and discussion.

Result

The data in this study were obtained from morphometric measurements, Body Condition Score (BCS) assessments, and body weight recordings of adult male and female Timor deer at the Jatilengger Deer Breeding Center, Blitar Regency. All samples were measured in healthy condition and within the same observation period. In general, the data show variations in body size among individuals in both the male and female groups, which were further analyzed to examine the relationships between morphometric traits, BCS, and body weight.

Table 1. Morphometry of adult male and female Timor deer in Jatilengger Captivity.

Parameters	Adult Male Timor Deer \pm SD	Adult Female Timor Deer \pm SD
Body Length (cm)	78,7 \pm 5,80	66,5 \pm 5,84
Body Height (cm)	75,0 \pm 5,56	62,4 \pm 6,30
Chest Girth (cm)	92,7 \pm 4,21	70,5 \pm 3,58
Body Weight (kg)	77,4 \pm 4,05	45,2 \pm 3,35
Body Condition Score	3,12 \pm 0,44	2,5 \pm 0,31

Descriptively, the morphometric values in the male group tend to be higher than those of the females across almost all parameters, particularly chest girth and body length, which show the most noticeable differences. This indicates the presence of natural sexual dimorphism in Timor deer, in which males have larger body sizes. Nevertheless, some parameters such as ear length or shoulder height may show smaller differences compared to other measurements.

Table 2. Correlation between morphometry–BCS and body weight in adult male Timor deer

Correlation Adult Male Timor Deer		
Variable (X)	Correlation (r)	Strength of Association
Body Length	0,602	Moderate-Strong
Body Height	0,688	Very Strong
Chest Girth	0,987	Strong
Body Condition Score	0,901	Very Strong

In adult male Timor deer, the correlation analysis shows that several body parameters have strong associations with body weight. Chest girth exhibits the highest correlation ($r = 0.987$), making it the most

accurate indicator for predicting body weight in males. The Body Condition Score also demonstrates a very strong correlation ($r = 0.901$), indicating that overall body condition greatly influences variations in body weight. Body height shows a very strong relationship as well ($r = 0.688$), while body length presents a moderate-to-strong correlation ($r = 0.602$). Overall, chest girth and BCS serve as the most dominant predictors for estimating body weight in adult male Timor deer.

Table 3. Correlation between morphometry–BCS and body weight in adult female Timor deer

Correlation Adult Female Timor Deer		
Variable (X)	Correlation (r)	Strength of Association
Body Length	0,638	Strong
Body Height	0,696	Strong
Chest Girth	0,800	Strong
Body Condition Score	0,719	Strong

In adult female Timor deer, the correlation analysis indicates consistently strong relationships between body measurements and body weight. Chest girth shows the highest correlation ($r = 0.800$), identifying it as the most influential parameter for predicting body weight in females. Body Condition Score also demonstrates a strong association ($r = 0.719$), suggesting that overall body condition contributes meaningfully to weight variation. Body height ($r = 0.696$) and body length ($r = 0.638$) similarly exhibit strong correlations, indicating that these morphometric traits play important roles in determining body weight. Overall, chest girth remains the dominant predictor, supported by strong contributions from BCS, body height, and body length in adult female Timor deer.

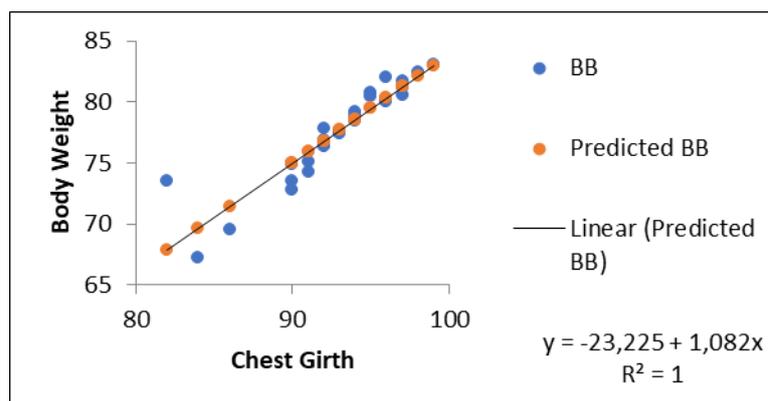


Figure 1. Linear Regression of BW–CG in Adult Male Timor Deer

The linear regression analysis between chest girth and body weight in adult male Timor deer shows a strong positive linear relationship, as indicated by the regression equation $y = -23.225 + 1.082x$ and an R^2 value of 1. This suggests that chest girth is an excellent predictor of body weight, with increases in chest girth corresponding directly to increases in predicted body weight. The close alignment between the observed and predicted values further demonstrates the high accuracy of this model in estimating body weight based on chest girth measurements.

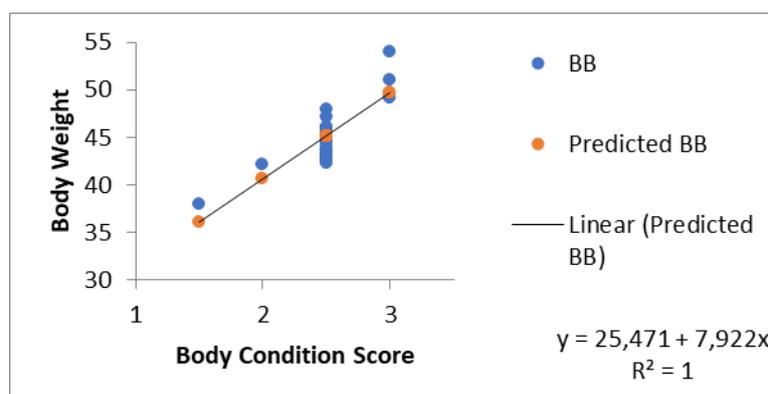


Figure 2. Linear Regression of BW–CG in Adult Male Timor Deer

The linear regression between Body Condition Score and body weight in adult female Timor deer shows a clear positive linear relationship, as reflected by the regression equation $y = 49.200 + 9.000x$ and an R^2 value of 1. This indicates that BCS is a strong predictor of body weight, with higher condition scores corresponding to proportionally higher predicted weights. The close overlap between observed and predicted values further demonstrates the accuracy and reliability of this model in estimating body weight based on BCS in female Timor deer.

Discussion

The results of this study demonstrate that morphometric measurements and Body Condition Score (BCS) provide a reliable reflection of the physiological condition of adult Timor deer, indicating that external body traits can be used effectively to estimate internal body mass. The strong correlations found in both sexes confirm that morphometric traits particularly chest girth serve as dependable predictors of body weight. This supports the findings of Fayazi et al. (2021), who emphasized that chest girth accurately represents thoracic volume and contributes significantly to the prediction of total body mass in ruminants. The biological basis for this relationship lies in the fact that increases in chest circumference generally reflect expansions in skeletal frame, musculature, and fat reserves, all of which contribute directly to body weight.

The high correlation and determination values observed in this study reinforce the concept that chest girth can explain a substantial proportion of body weight variability. Comparable studies in goats (Shirke et al., 2024) and cattle (Ali et al., 2021) likewise identified chest girth as the most influential morphometric parameter for live weight estimation. These consistent findings across species suggest that chest girth represents a universal biometrical indicator applicable to diverse ruminant populations. The ability of chest girth to predict body weight with high accuracy underlines its practical advantage, especially in wildlife breeding centers where weighing scales may be limited.

BCS also showed a strong association with body weight in both male and female Timor deer, confirming that body condition reflects subcutaneous fat thickness and energy reserves. This finding aligns with the work of Levine et al. (2022), who noted that BCS provides a meaningful proxy for fat deposition in cervids, making it a valuable health-monitoring tool. Zielke et al. (2018) further reported that maintaining BCS values within the moderate range (3.0–3.5) optimizes reproductive performance, immunity, and overall welfare. The present study supports these conclusions, demonstrating that increases in BCS are closely linked with proportional increases in body weight.

The sexual dimorphism identified in this study characterized by larger body size, higher chest girth, and greater BCS values in males is consistent with reports by Maha et al. (2021) and Abram et al. (2024). These differences can be attributed to the role of testosterone, which promotes bone elongation, muscle hypertrophy, and secondary sexual characteristics, as described by Putra et al. (2020). Conversely, the relatively smaller body size of females may reflect evolutionary adaptations related to agility, energy efficiency, and maternal investment, which are essential for reproductive success in deer species.

When integrated into broader theoretical frameworks, the findings of this study align with established principles of cervid biology, particularly the relationships among morphology, nutritional status, and physiological function. Moreover, the strong predictive performance of morphometric traits especially chest girth supports the development of species-specific regression models for body weight estimation. These models can be considered theoretical contributions that refine existing prediction equations for *Cervus timorensis*, offering improved precision for population monitoring in captive settings.

From a management perspective, the implications of this study are significant. Accurate non-invasive weight estimation facilitates health assessment, growth monitoring, and the identification of superior breeding candidates. The integration of morphometric measurements and BCS also supports evidence-based decision-making in ex-situ conservation programs, enabling managers to evaluate nutritional adequacy, adjust feeding strategies, and monitor population condition without relying on specialized weighing equipment. These practical applications highlight the value of morphometric–BCS assessment as a sustainable management tool for Timor deer.

Overall, this study contributes to the growing body of knowledge on cervid morphometrics by confirming the dominant predictive role of chest girth and the supportive role of BCS in determining body weight. The consistency of these findings with previous research strengthens the theoretical understanding of physical condition assessment in ruminants and provides a foundation for future model refinement, including seasonal, age-class, or reproductive-status variations in Timor deer populations.

CONCLUSION

There is a strong and significant correlation between morphometric traits and BCS with body weight in adult Timor deer. Chest girth serves as the most accurate and practical predictor for estimating body weight, while BCS provides complementary insight into the animal's energy reserves and physiological status. The integration of these parameters is essential for improving deer management, feeding evaluation, and breeding selection in captive breeding programs. Future studies are recommended to examine seasonal variations and nutritional factors that influence morphometric development and BCS dynamics in Timor deer populations.

REFERENCES

- Abram, T., Wulandari, N., and Syafitri, D. (2024). Sexual dimorphism and morphometric analysis of Timor deer (*Cervus timorensis*). *Journal of Tropical Animal Science*, 11(2), 77–86.
- Fayazi, J., Asadi, A., and Nematollahi, A. (2021). Relationship between body measurements and body weight in ruminants. *Journal of Animal Science and Research*, 5(3), 145–152.
- Hastono, S. P. (2022). *Analisis Data dan Hand Out Statistik*. Universitas Indonesia.
- Kleinlugtenbelt, J., Raharjo, B., and Suwignyo, B. (2021). Morphometric characteristics of captive deer populations in Indonesia. *Indonesian Journal of Wildlife Science*, 7(1), 32–40.
- Levine, M., Torres, J., and Hsu, K. (2022). Body condition scoring and its correlation with fat percentage in deer. *Journal of Wildlife Management*, 86(4), 789–797.
- Maha, A., Putra, R., and Rahman, F. (2021). Morphometric characteristics and body condition assessment in Timor deer (*Cervus timorensis*). *Tropical Animal Production Journal*, 9(1), 45–52.
- Nafiu, M., Rahmat, I., and Sudarma, D. (2020). Habitat degradation and population trends of Timor deer. *Biodiversitas Indonesia*, 21(8), 3874–3881.
- Putra, D., Setiawan, Y., and Firmansyah, I. (2020). Hormonal influence on sexual dimorphism in cervids. *Indonesian Journal of Animal Physiology*, 5(2), 91–98.
- Setiyono, A., Hartono, T., and Wahyudi, A. (2018). Conservation efforts of Timor deer (*Cervus timorensis*) through captive breeding in Java. *Jurnal Konservasi Hayati*, 4(2), 55–63.
- Shirke, A., Rao, K., and Devi, L. (2024). The relationship between body condition score and live weight in goats. *Asian Journal of Animal Science*, 13(2), 122–130.
- Suparta, W., Ningsih, E., and Rachman, D. (2022). Environmental and nutritional influences on morphometric variation in captive deer. *Journal of Tropical Animal Conservation*, 8(1), 24–31.
- Zielke, L., Henderson, P., and Collins, A. (2018). Body condition scoring as a welfare indicator in captive deer. *Applied Animal Behaviour Science*, 202(2), 91–98.