Research

Phenotypic Relationship and Variation Between Morphometric Traits in Two Weeks Old Vencobb Broilers

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ABSTRACT

Developed in the 1990s, Vencobb broiler birds have gained popularity as a commercial strain due to their high meat yield. The present study was undertaken to study the genetic interrelationship between different morphometric traits and body weight in 200 unsexed Vencobb birds at two weeks of age. The experiment was performed during the month of December, 2025 and the birds were fed a basal diet of ground corn mash. Body weight, body length, wing length, body girth, keel bone length, thigh length, shank length and shank width were recorded. Body weight was found to have a low to moderate correlation with the different morphometric traits. By studying the association between different traits, we can select the birds which could have a higher body weight based on their correlation. Using the data recorded, the coefficient of variation was also calculated from the mean and standard deviation. At the current age, muscle development and bone growth occurs at varying levels due to difference in nutrient absorption. While recorded measurements often don't vary significantly in a population, there is higher variation in the body weight due to the influence of different factors.

Keywords: Broiler, Coefficient of variation, Correlation, India, Vencobb

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INTRODUCTION

The Indian subcontinent exhibits high variability in biodiversity within livestock species (Kamal *et al*., 2024). In terms of meat production, India currently ranks at the 4th position in the world. During the year 2024-2025, poultry meat accounted for 49% of the total meat production in the country (BAHS, 2025). Not only is it one of the fastest growing meat production sectors in the country but it can be consumed by most communities without any religious or cultural taboo (Hayat *et al*., 2023). Over the past few decades, an improvement in genomics, managemental practices, and nutrition has resulted in broilers reaching a market weight of 2 kg as early as 5 weeks (Devatkal *et al*., 2019). In addition to body weight, conformation traits are known to be good indicators of good growth and market value of broilers (Ibe, 1989).

Conformation traits also known as morphometric traits or linear body measurements are important parameters in predicting body weight and has been reported by commercial breeders and producers (Ojedapo *et al*. 2010). By characterizing morphometric traits, their role in breed selection, breeding, conservation and adaptability of livestock species can be understood (Durosaro *et al*., 2019). Further, these traits can be used in classifying and distinguishing between exotic and indigenous breeds as well as commercial birds (Yakubu *et al*., 2009). Nosike *et al*. in 2017 reported that morphometric traits such as shank length, keel bone length, body length, wing length and body girth were associated with longer bones in birds. The interrelationship and association between linear body measurements and body weight can be used for predicting body weight and carcass traits without unnecessary slaughter (Patbandha *et al*., 2017).

Due to insufficient consumption of animal protein in developing countries, there has been a need to create strains which can sell better in the market (Christopher *et al*., 1997). Broiler breeding companies have shifted their focus to developing and breeding new strains of established breeds which have a faster weight gain and reduced market age (Rekaya *et al*., 2012). A commercial strain of broiler birds, the Vencobb strain was developed by Venco Research and Breeding Farm Private Limited to reach maturity early, have a better feed conversion ratio and adaptability to tropical climates when compared to conventional broiler birds (Rathod *et al*., 2023). The strain was developed from Cornish cobb crosses and has white plumage. At two weeks of age also known as the starter phase, there is development of the digestive system and rapid organ growth (Lamot, 2017). An underdeveloped gut system can lead to malabsorption of nutrients directly hindering growth and impeding body weight gain (Molenaar *et al*., 2008). By weighing the body weight and recording the measurements during the starter phase, we are

able to evaluate their growth performance and possibly predict their weight at market age. The present study was performed to assess the variation in conformation traits and find out the association between body weight and morphometric traits at two weeks of age.

MATERIALS AND METHODS

The present study was undertaken at the Livestock Farm complex, Parikrama Veterinary Science College, Kashti in Maharashtra during the winter season. The geographical coordinates are 18.5492°N and 74.5822°E and it is situated 500-600 m above sea level. The temperature of the farm ranged from 14°C at night to 38°C during the day with the humidity ranging from 21 to 50 percent. The area is situated in a drought prone area and receives an annual rainfall of 520 mm. For the current study, 200 unsexed birds were selected and segregated from the base population in the same shed. The birds were reared under intensive conditions in a deep litter system. They were reared on a basal diet of ground corn mash and provided with water ad libitum. The birds had been vaccinated for Marek's disease and Ranikhet's disease as per protocol. Each bird was tagged with a numbered leg band to prevent repetition while recording the weight and morphometric measurements. The live body weight was recorded using a digital weighing balance (Exide weighing balance) as described by Tyasi *et al*. in 2021. The morphometric measurements were recorded as follows for each trait using a tailor's measuring tape (Matsambu *et al*., 2025). The shank width was recorded using a digital Vernier caliper (Precision Measuring Digital Caliper 150 mm).

Body length: Distance between the base of the neck to the pygostyle (Ebong *et al*., 2023)

Body girth: The measurement around the deepest portion of the breast using a measuring tape (Ebong *et al*., 2023)

Keel bone length: Length from the anterior to the posterior end of the sternum (Nosike *et al*., 2017)

Wing length: Measurement between the tips of the phalanges and the shoulder joint (Parte *et al*., 2024)

Thigh length: Distance between hock joint and pelvic joint (Ebong *et al*., 2023)

Shank length: Length from hock joint to bottom of foot pad (Nosike *et al*., 2017)

Shank width: Width at the midpoint of the shank (Mushi *et al*., 2020)

Using SPSS version 26 descriptive statistics for each measurement was calculated. Using the formula (Nabi *et al*., 2022), coefficient of variation was calculated from the mean and standard deviation values for each morphometric trait.

CV% = (Standard deviation/mean) X 100

Correlation values were estimated for the live body weight and morphometric traits using Pearson's correlation coefficient on SPSS version 26 (Mustafa, 2016).

RESULTS

The present study was undertaken at the Livestock Farm complex, Parikrama Veterinary Science College, Kashti, Maharashtra. Live body weight and morphometric measurements were recorded on 200 Vencobb birds at two weeks of age. Live body weight ranged from 113 to 344 g. The overall mean body weight was 221.24$\pm$2.81grams and the standard deviation was 39.73 g. The body length ranged from 11 to 18 cm and had an overall mean of 13.85$\pm$0.08 cm. The body girth measured at the widest portion of the breast muscle ranged from 13.5-21 cm with a mean value of 16.99$\pm$0.09 cm. The keel bone length ranged from 4 to7 cm and had an average overall mean of 5.45$\pm$0.04 cm. Wing length ranged from 4.5 to 16.5 cm and the average value was 6.38$\pm$0.07 cm. Thigh length demonstrated a range of 4 to 8 cm with an average value of 5.85$\pm$0.04 cm. The shank length had a range of 3-7 cm and an average measurement of 4.74$\pm$0.05cm. A range of 0.41 to 0.79 cm was observed for shank width and the mean shank width was found to be 0.59$\pm$0.01 cm.

The coefficient of variation per cent was 17.96, 8.90, 7.27, 11.35, 15.64, 9.90, 15.64 and 13.40, for body weight, body length, body girth, keel length, wing length, thigh length, shank length and shank width, respectively (Table 1).

Using Pearson's correlation coefficient, the correlation values between live body weight and linear morphometric traits were estimated (Table 2). The same is given in Figure 1 in a visual format. The body weight was found to have a significant moderate correlation with body length, body girth, keel length, thigh length and shank width ($P<0.01$). The wing length and shank length was found to be weakly correlated with body weight ($P<0.05$). The body length was found to have a low and significant correlation with body girth, keel length, wing length, thigh length and shank width ($P<0.05$). Correlation was not significant between shank length and body length. Body girth was found to have a low to moderate positive correlation with other morphometric traits ($P<0.01$). Keel bone length was weakly correlated with wing length, thigh length, shank length and shank width ($P<0.01$)

Table 1: Descriptive statistics for body weight and morphometric measurements

Trait (n=200) Value	BW (grams)	BL (cm)	BG (cm)	KL (cm)	WL (cm)	TL (cm)	SL (cm)	SW (cm)
Range	113-344	11-18	13.5-21	4-7	4.5-16.5	4-8	3-7	0.41-0.79
Mean±SE	221.24±2.81	13.85±0.08	16.99±0.09	5.45±0.04	6.38±0.07	5.85±0.04	4.74±0.05	0.59±0.01
Std. Deviation	39.73	1.23	1.23	0.62	0.99	0.58	0.74	0.08
CV%	17.96	8.90	7.27	11.35	15.64	9.90	15.64	13.40

BW-live body weight, BL-body length, BG-body girth, KL-keel bone length, WL-wing length, TL-thigh length, SL-shank length, SW-shank width

Table 2: Correlation table for different morphometric traits

	BW	BL	BG	KL	WL	TL	SL	SW
BW	1							
BL	0.397307**	1						
BG	0.568554**	0.256044**	1					
KL	0.475002**	0.215881**	0.331663**	1				
WL	0.169745*	0.245069**	0.185184**	0.144382*	1			
TL	0.309694**	0.24197**	0.368924**	0.190464**	0.170641*	1		
SL	0.222305**	0.129831	0.350425**	0.292049**	0.242871**	0.084683	1	
SW	0.541926**	0.20379**	0.282645**	0.343667**	0.126799	0.044231	0.194444**	1

**Correlation is significant at the 0.01 level; *Correlation is significant at the 0.05 level

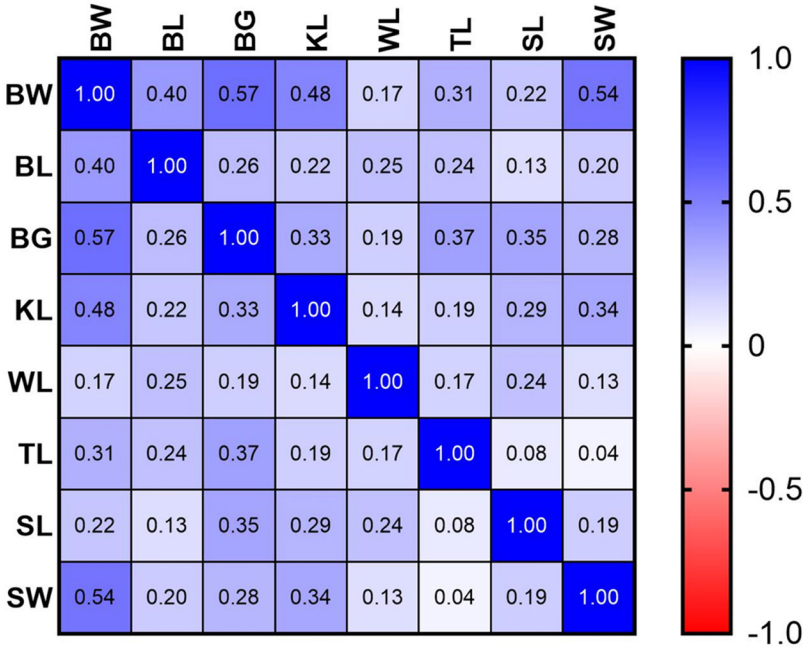

Fig. 1: *Visual map of correlation values for different traits using GraphPad Prism 11.*

DISCUSSION

The live body weight and morphometric traits were recorded on 200 Vencobb birds at two weeks of age during the winter season. Presented in Table 1, the overall mean value of 221.24±2.81 g was found to be less than Vencobb 400 broiler (409.34 g) strain as reported by Rathod *et al*., in 2023. A study by Singh *et al*., in 2019 reported that the average body weight was 353.35 g in Vencobb birds at two weeks of age which was in disagreement with the weight of the birds from our study. It was however, found to be more than what was reported in Vanaraja PD1 which had a mean body weight of 127.98±0.001 g as reported by Padhi *et al*.,

2015. It was reported by Smith *et al*., 1998 that strains within a breed can also have different feed intakes. Although a balanced diet maybe formulated to meet the bird's dietary requirements, digestibility and availability of nutrients differs within the flock. It has also been reported that low airflow rates during cold season contributed to elevated ammonia levels in the broiler shed leading to respiratory issues and decreased production performance (David *et al*., 2015).

The body length had an overall mean of 13.85±0.08 cm which was found to be below than what Patbanda *et al*., 2024 observed for male (33.44±0.18 cm) and female (33.54±0.16 cm) Caribro-Dhanraja broilers. Weimer *et al*., 2020 observed that body length was 12.6±0.29 cm for commercial broiler strains which was less than what was reported in the current study. The average body girth was found to be 16.99±0.09 cm which was only slightly lower than what Patbanda *et al*., 2024 reported for Caribro-Dhanraja males (17.08±0.11 cm) and females (17.01±0.09 cm). A study by Kareem *et al*., 2016 reported that the average body girth for Anak and Shaver strains at two weeks of age were 14.20 cm and 12.80 cm, respectively, which were both lower than the current findings. The mean keel bone length was observed to be 5.45±0.04 cm. Patbanda *et al*., 2024 reported that the mean keel bone length was found to be 7.60±0.06 cm and 7.39±0.05 cm for male and female Caribro-Dhanraja broilers, respectively, which was higher than what was reported in the Vencobb flock. Another study (Weimer *et al*., 2020) found that the keel bone length of two commercial strains ranged from 7.32 to 7.74 cm which was higher than the present findings. A study by Kareem *et al*., 2016 observed that the keel bone length for Anak and Shaver strains were 6.02 cm and 5.55 cm, respectively, which was slightly higher than what was reported in the current study.

An average wing length of 6.38±0.07 cm was estimated which was less than those (11.15 ± 0.13 cm) reported by Patbanda *et al*., 2024 for Caribro-Dhanraja broilers. Similarly, another study by Kareem *et al*., 2016 reported that the average wing length for Anak (10.51 cm) and Shaver (9.88 cm) strains were higher than the overall mean wing length reported from the current flock of Vencobb birds. The average thigh length from the current study was measured as 5.85±0.04 cm. For Caribro-Dhanraja broilers, the mean thigh length was reported to be 7.38±0.07 cm and 7.34±0.07 cm for males and females, respectively, by Patbanda *et al*., 2024 which was in disagreement with the current findings. The average shank length and shank width were 4.74±0.05 cm and 0.59±0.01 cm respectively. Patbanda *et al*., 2024 reported that the shank length for Caribro-Dhanraja broilers was found to be 5.65±0.05 cm and 5.57±0.05 cm for males and females, respectively which was more than the values estimated in the current study. Another study by Weimer *et al*., 2020 reported that shank length ranged from 4.20 to 4.54 cm for commercial broiler strains which was in agreement with the findings of the current study. The same study reported that the average shank width was 0.82±0.03 cm which was higher than those reported in this study.

It has been reported that conformation traits are affected by strain, breed, nutrition and managemental systems (Singh *et al*., 2018). At the time of the study, authors were unable to find any information related to the morphometric measurements for Vencobb birds at two weeks of age. While the coefficient of variation was below 10% for body length, body girth and thigh length, it was above 10% but less than 20 % for live body weight, keel bone length, wing length, shank length and shank width. A broiler flock with up to 10% CV is considered to be a flock with good uniformity. The difference in uniformity of traits could be a result of environmental and managemental influences (Rack *et al*., 2008). It has been reported that a combination of high ammonia levels and lysine deficiency can decrease the uniformity of the flock (Leclercq *et al*., 1994). In 2006, Gous and Berhe reported that decreased uniformity is a result of being fed feeds deficient in an essential nutrient which enables broilers to overconsume energy when faced with a deficiency. This characteristic enabled the better performing birds to show little reduction in growth, whereas the feed intake of others, without the capacity to deposit as much lipid, could be severely constrained, resulting in poor growth. Insufficient calcium and phosphorous in the diet reduces bone calcification (Hurwitz *et al*., 1995). In the present study, live body weight was observed to have the highest phenotypic correlation with all the morphometric measurements recorded indicating that selection for any one of the highly correlated traits can be used for predicting birds with higher body weight (Adeleke *et al*., 2004). Sam *et al*., 2019 reported a similar range in correlation values as the present study for body length, keel bone length and thigh length. The strong moderate correlation between body weight, body length and body girth was less compared to the values reported for the same traits in FUNAAB Alpha birds. At the time of this study, the authors were unable to find any previously published reports of body weight and morphometric traits in Vencobb birds at two weeks of age.

CONCLUSION

The present study estimated the overall mean and CV% for live body weight and different morphometric traits. Although less than 10 % CV indicated good overall uniformity in a flock, up to 20 % variation is acceptable under field conditions. The difference

in CV% in morphometric traits is a result of muscle development and skeletal growth occurring at varying degrees which can be attributed to the differences in nutrient absorption. The current study reported a low to moderate significant phenotypic correlation between body weight and linear body measurements. Positive and significantly correlated traits such as body girth, shank width and keel bone length can be used as criteria for predicting birds with higher live body weight. Morphometric traits can also be used as a potential method to determine which birds would have a larger body weight overall in the absence of weighing scales. To conclude, more studies will have to be undertaken in future with different breeds and under different seasons to give us a better understanding of correlation between traits and to use it for predicting birds with higher body weight.

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