PHENOTYPIC VARIABILITIES IN STRAIN AND SEX OF TWO-BROILER CHICKENS AT DIFFERENT AGES

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ABSTRACT: *Owing to the growing number of animal breed development centres around the world and the profitability of their production, comparative studies to evaluate superior strain and sex performance in breeders became an important endeavour for researchers. Hence, this study was designed to evaluate the effects of strain and sex on body weight and linear body morphometric traits of 2-broiler chickens during the starter and finisher phases. Arbor-Acre and Cobb-500 chicks (n=192) were raised under controlled conditions and monitored over 56 days. Weekly measurements of body weight and linear body traits were recorded. Data subjected to multivariate analysis using the SPSS package revealed that strain significantly (p<0.05) influenced growth, with Arbor-Acre broilers exhibiting superior body weight performance, particularly during the starter phase, weighing 799.50g compared to 669.11g for Cobb-500. This result implied that selecting for improved growth performance during the starter phase (week four) was an important consideration for breeding farms. However, the sex and age factors, as well as the linear body traits in both strains, yielded similar economic results at 8 weeks. Male broilers consistently outperformed their female counterparts in body morphometric traits during both phases. The sex-based differences observed in this study varied across developmental stages, emphasizing the importance of sexual dimorphism in broiler management. These findings recommended that strain and sex were important factors to consider in optimizing broiler production, providing critical insights for broiler breeders and farmers to enhance production efficiency through strategic selection of strains, sex, and other environmental factors.*

KEYWORDS: Poultry production, Broiler chickens; Morphometric traits; sexual dimorphism.

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INTRODUCTION

The poultry industry plays a vital role in boosting employment opportunities and supplying animal protein in the country. Jaturashita (2004) noted that the high demand for poultry meat is attributed to its health benefits compared to red meat, including lower fat and cholesterol levels, relatively low prices, convenient portion sizes, and the absence of religious restrictions. The sector's growth has been primarily driven by an increase in the number of broilers, which produce higher meat yields per bird (Adeyonu *et al.,* 2021). Factors such as genetics and environmental conditions significantly influence feed consumption and utilization (Abdullah *et al.,* 2010). Studies have demonstrated that linear body traits, including body length, body weight, chest girth, trunk length, and shoulder-to-tail length, are strongly affected by genotype and sex, even in pigs (Morenikeji *et al.,* 2019). In poultry, Atansuyi *et al.* (2018) highlighted breast girth (BRG) as a reliable selection criterion for breeding stock to enhance growth rates. Kareem-Ibrahim *et al.* (2021) observed that while feed type had a notable impact, interactions between strain and sex did not significantly affect all growth parameters of broilers. Yahaya *et al.* (2012) highlighted that body weight, along with conformation traits such as breast girth, shank length, back length, and keel length, serves as a reliable indicator of growth and market value in broilers. Similarly, researchers have reported notable differences in body weight and other morphometric parameters among various strains and sexes of chicken (Razuki, 2002; Olawumi *et al.*, 2012; Ojedapo *et al.*, 2016; Sam *et al.*, 2019). Evaluating these traits is crucial to provide reliable information that can guide researchers and farmers in selecting the most suitable broiler strains for enhanced growth, meat production, and optimal profitability. Consequently, the aim of this study was to assess the impact of strain and sex on morphometric traits of broiler chicken at the starter and finisher phases of production.

MATERIALS AND METHODS

Experimental Site

The study was carried out at the Poultry Unit of the Teaching and Research Farm, The Federal University of Technology, Akure, Ondo State, Nigeria located between latitude $07°16^1$ and $07°18^1$ N and longitude $05°09^1$ and $05°11^1$ E. There is a bimodal rainfall patterns which start from February to July and September to October with an average rainfall of 1,556 mm per annum. The average ambient temperature is about 30-32°C with a relative humidity of 80% (Climate Data, 2018).

Management of the Experimental Animals

A total of 192 day-old chicks, consisting of Arbor-Acre and Cobb-500 broiler strains, were purchased from reputable farms. The chicks were randomly assigned to pre-labelled pens based on their strains and sexes, resulting in four groups with three replicates per group. They were raised intensively on a deep litter system for eight weeks (56 days). Routine and occasional health management practices were strictly followed throughout the study. All necessary vaccinations and medications were administered as required. The experimental diet (crude protein = 22 and 20%; ME = 2,900 and 3,000 kcal/kg for starter and finisher feeds respectively) was formulated at the Feed Mill of the Federal University of Technology Akure (FUTA) Teaching and Research Farm, Ondo State, Nigeria, and the birds were fed *ad-libitum* during the experiment.

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Data Collection

Body weights and linear body measurements were recorded in the morning before the birds were fed, following the procedure outlined by Egena *et al.* (2010). Each bird was carefully and humanely restrained before any measurements were taken. Body weight was measured in grams using an electronic sensitive scale with a maximum capacity of 5 kg, while the other linear body measurements were taken with a measuring tape (Butterfly Brand®), with values recorded in grams and centimetres, respectively. The morphometric traits were measured at the following reference points: Body weight (BWT), breast girth (BRG), trunk length (TRL), shoulder-to-tail length (STL), shank length (SHL), drumstick length (DSL), nose-to-shoulder length (NTS), wing length (WGL), and circumference. The description of the linear body measurements otherwise called morphometric traits, is given below:

(a) Body weight (BWT): It was measured in grams using a sensitive weighing scale.

(b) Breast Girth (BRG): This was measured as the body circumference just behind the wing.

(c) Trunk length (TRL): This is the longitudinal distance from the point of the shoulder to the tuberosity of the ischium.

(d) Shoulder to tail length (STL): This is the distance from the point of the shoulder to

the pin bone or the end of the coccygeal vertebrae.

(e) Shank length (SHL): This is the distance from the knee joint to the foot.

(f) Drum stick length (DSL): This is the distance between the hinge and hock joints.

(g) Nose to Shoulder (NTS): This is the distance from the nose to the point of the shoulder.

(h) Wing length (WGL): This was measured on the dorsal midline to the highest point of

the wing.

(i) Circumference: The distance around the body just under the wing

The recorded body weight and linear body measurements were used for statistical analysis.

Statistical Analysis

All data collected were subjected to multivariate analysis using the software SPSS version 25.0 (IBM Corp, 2017) following a completely randomized design with a 2 x 2 factorial arrangement. The statistical model used for the combined interactions of strain and sex was as follows: $Y_{ijk} = \mu + S_i + X_j + (SX)_{ij} + \varepsilon ijk$

Where:

Y_{ijk} = Observation of a bird for i^{th} strain in the j^{th} sex (n = 1 - 192);

μ = General mean for specific population;

S_i = Effect of the i^{th} strain (i = 1-2)

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X_j = Effect of the j^{th} sex (j = 1-2);

SX_{ijk} = Interaction effect of i^{th} strain and j^{th} sex on the experimental chickens; and

εijk = Experimental Error.

RESULTS AND DISCUSSION

Table 1 illustrates the effects of strain on the morphometric parameters of broiler chickens during the starter phase. Significant strain differences ($p<0.05$) were observed in linear body measurements across all ages. Arbor Acre (AA) birds consistently outperformed Cobb-500 in body weight (BWT), ranging from 140.86g at week 1 to 779.50g at week 4, compared to Cobb's 92.55g to 669.11g, indicating a higher growth rate in AA birds. These findings align with Razuki *et al.* (2011) and other studies (Razuki *et al.,* 2007; Olawumi *et al.,* 2012; Fadare *et al.*, 2020) attributing strain differences to genetic potential. Breast girth (BRG) showed no significant differences at weeks 1 and 4. However, at weeks 2 and 3, AA birds had significantly wider BRG (10.86cm and 12.95cm) than Cobb-500 (9.30cm and 11.81cm). These results corroborate earlier studies reporting strain-specific differences in body weight and growth (Olawumi *et al.*, 2012; Sanda *et al.*, 2014; Fadare *et al.*, 2020). Strain effects were also evident in trunk length (TRL), shoulder-to-tail length (STL), and shank length (SHL) throughout the starter phase, with AA birds consistently exhibiting higher values. Drumstick length (DSL) was significantly different ($p<0.05$) between strains in weeks 1 to 3, with AA having longer DSL in weeks 1 and 2, but Cobb-500 surpassing AA at week 3 (8.97cm vs 7.82cm). At week 4, no significant difference in DSL was observed. Nose-to-shoulder length (NTS) showed a significant difference ($p<0.05$) at week 3, with Cobb-500 recording a higher value (10.84cm) than AA (10.42cm). Wing length (WGL) and circumference (CIR) were significantly higher ($p<0.05$) in AA at weeks 2 and 4, while Cobb-500 surpassed AA in week 3 for both traits (14.08cm and 18.08cm vs 13.46cm and 17.13cm, respectively). No significant differences ($p>0.05$) were noted for WGL and CIR at week 1 (Fadare *et al.*, 2020; Akinsola *et al.*, 2021). In summary, AA birds exhibited superior growth in traits like STL, SHL, and DSL, while Cobb-500 showed advantages in NTS, WGL, and CIR at specific weeks. These findings underline the distinct growth characteristics of the two strains and align with previous research on strain-specific growth patterns in broilers (Fadare *et al.,* 2020; Olawumi *et al.*, 2012).

The effects of strain on body weight and linear measurements of broiler chickens from weeks 5 to 8 are presented in Table 2. Significant differences ($p<0.05$) in body weight were observed between strains across all weeks except week 8. The Arbor Acre strain consistently exhibited superior body weight, recording 1174.87g, 1660.84g, and 1758.31g at weeks 5, 6, and 7, respectively, compared to the Cobb-500 strain's 924.20g, 1290.72g, and 1610.67g for the same weeks. For breast girth (BRG), significant differences ($p<0.05$) occurred at weeks 5 and 6. Cobb-500 recorded a higher value (15.75cm) at week 5, while Arbor Acre measured 14.98cm. However, by week 6, Arbor Acre overtook Cobb-500, recording 18.50cm against Cobb's 17.50cm, demonstrating a growth surge in BRG for Arbor Acre. This suggests that long-term monitoring of growth provides better insights than early measurements alone. These results align with findings by Udeh and Ogbu (2011), who reported variations in body length and breast girth among broiler strains at different ages. Trunk length (TRL) showed non-significant differences ($p>0.05$) at week 8 but was significantly different ($p<0.05$) at weeks 5, 6, and 7.

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Arbor Acre surpassed Cobb-500 at weeks 5 and 6, while Cobb-500 demonstrated superiority at week 7. Similarly, drumstick length (DSL) differed significantly ($p<0.05$) between strains from weeks 5 to 7, with Arbor Acre consistently exhibiting larger drumsticks, reflecting differences in growth and development. These findings corroborate earlier studies by Udeh and Ogbu (2011) and Ojedapo *et al.* (2016), which also reported strain-based differences in body weight and linear measurements.

Table 3 outlines the effects of sex on the morphometric parameters of broiler chickens during the starter phase. A significant difference ($p<0.05$) in body weight (BWT) was observed at week 4, with males (760.71g) outweighing females (707.90g), consistent with studies reporting sexual dimorphism in body weight (Faith et al., 2018). For breast girth (BRG), no significant differences ($p>0.05$) were found between sexes throughout the starter phase, indicating that sex does not influence this trait during early development (Faith *et al.*, 2018). However, trunk length (TRL) exhibited a non-significant sex effect ($p>0.05$) at week 1 but a significant difference ($p<0.05$) at week 2, with males showing greater values. This suggests a sex-based influence on trunk length development, as supported by Bekele *et al.* (2021). Shoulder-to-tail length (STL) showed significant sex differences ($p<0.05$) only at week 2, where males (10.82cm) exceeded females (10.37cm). No significant differences ($p>0.05$) were noted for STL in other weeks (Bekele *et al.*, 2021). No significant sex effects ($p>0.05$) were observed on shank length (SHL), drumstick length (DSL), nose-to-shoulder length (NTS), or wing length (WGL) during the starter phase (Aluko *et al.*, 2013). However, circumference showed significant differences ($p<0.05$) at week 4, with males exhibiting larger values, while weeks 1-3 showed no significant differences (Bekele *et al.*, 2021). In summary, males generally had greater trunk length, shoulder-to-tail length, and circumference compared to females. Nonetheless, sex did not significantly influence other linear body measurements such as SHL, DSL, NTS, or WGL during this phase.

Table 4 highlights the significant effect ($p<0.05$) of sex on body weight at week 5 of the finisher phase, with males (1097.06g) outweighing females (1002.01g). This aligns with studies noting sexual dimorphism in body weight, where males are typically heavier (Sanda *et al.*, 2021; Egena *et al.*, 2014). Male broilers continued to exceed females in weight at week 6, though differences at weeks 7 and 8 were not statistically significant ($p>0.05$), despite males maintaining numerically higher values (Egena *et al.*, 2014). Breast girth (BRG) showed no significant differences ($p>0.05$) at weeks 5, 7, and 8. However, a significant difference ($p<0.05$) was observed at week 6, with males (18.40cm) exceeding females (17.65cm) (Sam and Okon, 2022). For trunk length (TRL), a significant sex effect ($p<0.05$) was observed only at week 5, with males showing longer measurements. Shoulder-to-tail length (STL) exhibited significant sex differences ($p<0.05$) at weeks 5 and 6, favouring males. Shank length (SHL) differed significantly ($p<0.05$) at week 5, but no differences ($p>0.05$) were observed in later weeks. Drumstick length (DSL) showed significant differences ($p<0.05$) between sexes at weeks 5 and 6, while weeks 7 and 8 recorded no significant variation ($p>0.05$). Nose-to-shoulder (NTS) and wing length (WGL) remained unaffected by sex ($p>0.05$) throughout the finisher phase. Circumference displayed significant sex differences ($p<0.05$) at weeks 5 and 6, with males recording larger values, but no significant differences were noted at weeks 7 and 8 (Faith et al., 2018; Sam and Okon, 2022).

The results of the interaction between strain and sex on body weight (BWT) and breast girth (BRG) of broiler birds during the starter phase in Table 5 revealed no significant difference ($p>0.05$), indicating that strain effects on these traits were not sex-dependent (Sanda *et al.*,

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2020). However, significant interactions ($p<0.05$) were observed for trunk length (TRL) and shoulder-to-tail length (STL) at week 2. For TRL, male Arbor Acre birds recorded the highest value (10.58 cm), followed by females (9.61 cm) (Sam and Okon, 2022), while Cobbs-500 males and females had the lowest and statistically similar values (8.69 cm and 8.70 cm). Similarly, STL values were highest in male Arbor Acre birds, while Cobbs-500 males and females recorded the lowest and statistically similar values (9.90 cm). Conversely, interactions between strain and sex on shank length (SHL) and drumstick length (DSL) were non-significant ($p>0.05$), suggesting that strain effects on these traits were not influenced by sex (Sanda *et al.,* 2020). Similarly, no significant interactions ($p>0.05$) were found for nose-to-shoulder length (NTS), wing length (WGL), or circumference, confirming that strain effects on these traits were unaffected by sex. In summary, significant interactions between strain and sex were evident only for TRL and STL at week 2, highlighting sex-dependent strain effects on these traits. However, for other morphometric traits, strain effects were consistent across sexes (Sanda *et al.,* 2020; Sam and Okon, 2022). Similarly, the finisher phase of the study showed no significant interactions ($p>0.05$) between strain and sex on BWT or BRG (Sanda *et al.,* 2020). For TRL, significant differences ($p<0.05$) occurred only at week 5, suggesting a transient strain–sex interaction (Sanda *et al.,* 2020). No significant interactions ($p>0.05$) were observed for STL, SHL, or DSL, indicating no sex influence on strain effects during this phase. Additionally, interactions between strain and sex on NTS, WGL, and circumference were non-significant ($p>0.05$), further confirming the absence of sex-based strain effects on these traits.

Table 1: Effects of strain on morphometric parameters of experimental birds at the starter phase

AGE	PRT STRAIN	BWT (g)	BRG (cm)	TRL (cm)	STL (cm)	SHL (cm)	DSL (cm)	NTS (cm)	WGL (cm)	CIR (cm)
1	COBB	92.55^{b}	7.38	7.03^{b}	7.50^{b}	3.11^{b}	5.58^{b}	6.78	7.78	12.24
	AA	140.86^{a}	7.44	7.39^{a}	8.14^{a}	3.36^{a}	5.81^{a}	6.92	7.87	12.42
	±SEM	1.72	0.11	0.11	0.11	0.04	0.08	0.17	0.12	0.08
	P-value	0.00	0.71	0.03	0.00	0.00	0.05	0.54	0.58	0.11
2	COBB	206.33^{b}	9.30^{b}	8.69^{b}	9.90^{b}	3.66^{b}	6.62^{b}	9.40	10.91^{b}	13.83^{b}
	AA	323.89^{a}	10.86^{a}	10.10^{a}	11.29^{a}	3.89^{a}	7.64^{a}	9.38	11.84^{a}	17.18^{a}
	±SEM	4.10	0.17	0.15	0.15	0.05	0.09	0.15	0.18	0.23
	P-value	0.00	0.00	0.00	0.00	0.00	0.00	0.92	0.00	0.00
3	COBB	435.59^{b}	11.81^{b}	11.82^{b}	13.16^{b}	4.54^{b}	8.97^{a}	10.84^{a}	14.08^{a}	18.08^{a}
	AA	558.76^{a}	12.95^{a}	12.10^{a}	13.54^{a}	4.84^{a}	7.82^{b}	10.42^{b}	13.46^{b}	17.13^{b}
	±SEM	11.71	0.14	0.09	0.13	0.09	0.10	0.08	0.15	0.14
	P-value	0.00	0.00	0.04	0.04	0.04	0.00	0.00	0.01	0.00
4	COBB	669.11^{b}	13.83	13.49^{b}	15.05^{b}	4.92^{b}	10.79	12.19	16.49^{b}	20.61^{b}
	AA	799.50^{a}	13.93	14.07^{a}	15.69^{a}	5.05^{a}	11.12	12.22	16.91^{a}	22.76^{a}
	±SEM	16.38	0.13	0.16	0.16	0.04	0.12	0.11	0.11	0.18
	P-value	0.00	0.61	0.02	0.01	0.02	0.07	0.89	0.02	0.00

$^{a,\ b,\ c}$ =means in the same column bearing different superscripts are significantly different ($p<0.05$), PRT = Parameter, SEM= Standard error of mean, P Value= Level of significance, AA= Arbor Acre, Cobb= Cobbs-500, BWT= Body weight, BRG= Breast girth, TRL= Trunk

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length, STL= Shoulder to tail, SHL= Shank length, DSL= Drumstick length, NTS= Nose to shoulder, WGL= Wing length, CIR= Circumference

Table 2: Effects of strain on morphometric parameters of experimental birds at finisher phase

AGE	PRT STRAIN	BWT (g)	BRG (cm)	TRL (cm)	STL (cm)	SHL (cm)	DSL (cm)	NTS (cm)	WGL (cm)	CIR (cm)
5	COBB	924.20^{b}	15.75^{a}	16.13^{b}	17.89^{b}	5.32^{b}	12.51^{b}	12.71^{b}	18.04^{a}	23.76^{b}
	AA	1174.87^{a}	14.98^{b}	17.03^{a}	18.63^{a}	5.39^{a}	13.76^{a}	13.55^{a}	15.76^{b}	25.32^{a}
	±SEM	19.32	0.15	0.15	0.16	0.02	0.08	0.12	0.33	0.13
	P-value	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
6	COBB	1290.72^{b}	17.55^{b}	16.90^{b}	18.87^{b}	5.84	13.35^{b}	14.44^{a}	18.35	25.57^{b}
	AA	1660.84^{a}	18.50^{a}	17.98^{a}	20.24^{a}	5.79	14.51^{a}	13.90^{b}	19.25	30.47^{a}
	±SEM	16.82	0.23	0.18	0.24	0.02	0.14	0.09	0.33	0.21
	P-value	0.00	0.01	0.00	0.00	0.18	0.00	0.00	0.07	0.00
7	COBB	1610.67^{b}	19.16	18.51^{a}	21.05^{a}	6.32	14.69^{b}	15.83	22.66	30.64^{a}
	AA	1758.31^{a}	19.40	17.05^{b}	19.48^{b}	6.29	15.62^{a}	15.86	21.11	29.78^{b}
	±SEM	33.50	0.16	0.20	0.22	0.04	0.14	0.17	0.91	0.28
	P-value	0.01	0.30	0.00	0.00	0.60	0.00	0.91	0.24	0.04
8	COBB	2122.04	25.31	19.74	22.43	7.20	16.02	15.81	22.82^{a}	32.67
	AA	2030.61	20.49	19.20	21.90	6.65	16.35	15.78	22.06^{b}	32.02
	±SEM	55.94	3.22	0.22	0.21	0.22	0.17	0.18	0.24	0.28
	P-value	0.26	0.30	0.09	0.09	0.08	0.19	0.91	0.03	0.11

$^{a, b, c}$ =means in the same column bearing different superscripts are significantly different ($p<0.05$), PRT = Parameter, SEM= Standard error of mean, P Value= Level of significance, AA= Arbor Acre, Cobb= Cobbs-500, BWT= Body weight, BRG= Breast girth, TRL= Trunk length, STL= Shoulder to tail, SHL= Shank length, DSL= Drumstick length, NTS= Nose to shoulder, WGL= Wing length, CIR= Circumference

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Table 3: Effects of sex on morphometric parameters of experimental birds at the starter phase

AGE	PRT SEX	BWT (g)	BRG (cm)	TRL (cm)	STL (cm)	SHL (cm)	DSL (cm)	NTS (cm)	WGL (cm)	CIR (cm)
1	M	116.88	7.37	7.18	7.76	3.20	5.76	6.91	7.87	12.33
	F	116.54	7.44	7.24	7.88	3.27	5.63	6.79	7.78	12.33
	±SEM	1.72	0.11	0.11	0.11	0.04	0.08	0.17	0.12	0.08
	P-value	0.89	0.67	0.72	0.44	0.29	0.23	0.65	0.62	0.98
2	M	267.14	10.10	9.64[a]	10.82[a]	3.77	7.15	9.37	11.39	15.50
	F	263.08	10.06	9.15[b]	10.37[b]	3.78	7.12	9.41	11.36	15.51
	±SEM	4.10	0.17	0.15	0.15	0.05	0.09	0.15	0.18	0.23
	P-value	0.49	0.86	0.03	0.04	0.96	0.82	0.83	0.91	0.99
3	M	503.25	12.46	12.06	13.39	4.77	8.38	10.72	13.81	17.70
	F	491.09	12.30	11.86	13.31	4.61	8.41	10.54	13.73	17.51
	±SEM	11.71	0.14	0.09	0.13	0.09	0.10	0.08	0.15	0.14
	P-value	0.47	0.41	0.13	0.67	0.25	0.85	0.15	0.74	0.33
4	M	760.71[a]	13.90	13.86	15.50	5.02	11.04	12.30	16.83	22.02[a]
	F	707.90[b]	13.86	13.70	15.23	4.94	10.86	12.10	16.57	21.35[b]
	±SEM	16.38	0.13	0.16	0.16	0.04	0.12	0.11	0.11	0.18
	P-value	0.03	0.85	0.46	0.26	0.13	0.31	0.21	0.13	0.01

[a, b, c] =means in the same column bearing different superscripts are significantly different ($p<0.05$), PRT = Parameter, SEM= Standard error of mean, P Value= Level of significance, M=Male, F= Female, BWT= Body weight, BRG= Breast girth, TRL= Trunk length, STL= Shoulder to tail, SHL= Shank length, DSL= Drumstick length, NTS= Nose to shoulder, WGL= Wing length, CIR=Circumference

Table 4: Effects of sex on morphometric parameters of experimental birds at finisher phase

AGE	PRT SEX	BWT (g)	BRG (cm)	TRL (cm)	STL (cm)	SHL (cm)	DSL (cm)	NTS (cm)	WGL (cm)	CIR (cm)
5	M	1097.06[a]	15.56	16.91[a]	18.57[a]	5.42[a]	13.29[a]	13.30	16.82	24.81[a]
	F	1002.01[b]	15.17	16.25[b]	17.96[b]	5.29[b]	12.98[b]	12.97	16.99	24.27[b]
	±SEM	19.32	0.15	0.15	0.16	0.02	0.08	0.12	0.33	0.13
	P-value	0.00	0.07	0.01	0.01	0.00	0.02	0.06	0.72	0.01
6	M	1528.06[a]	18.40[a]	17.67	19.97[a]	5.84	14.14[a]	14.26	19.03	28.44[a]
	F	1423.49[b]	17.65[b]	17.21	19.14[b]	5.79	13.71[b]	14.08	18.58	27.60[b]
	±SEM	16.82	0.23	0.18	0.24	0.02	0.14	0.09	0.33	0.21
	P-value	0.00	0.03	0.08	0.02	0.09	0.03	0.14	0.35	0.01
7	M	1699.06	19.51	17.79	20.32	6.29	15.20	15.80	22.77	30.31

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	F	1669.92	19.05	17.77	20.21	6.31	15.11	15.88	21.00	30.11
	±SEM	33.50	0.16	0.20	0.22	0.04	0.14	0.17	0.91	0.28
	P-value	0.55	0.06	0.93	0.75	0.82	0.68	0.75	0.18	0.63
8	M	2088.32	25.47	19.17	21.89	6.83	16.09	15.76	22.50	32.42
	F	2064.33	20.34	19.77	22.44	7.02	16.28	15.84	22.39	32.27
	±SEM	55.94	3.22	0.22	0.21	0.22	0.17	0.18	0.24	0.28
	P -value	0.77	0.27	0.07	0.08	0.55	0.45	0.75	0.74	0.70

[a, b, c] =means in the same column bearing different superscripts are significantly different (p<0.05), PRT = Parameter, SEM= Standard error of mean, P Value= Level of significance, M=Male, F= Female, BWT= Body weight, BRG= Breast girth, TRL= Trunk length, STL= Shoulder to tail, SHL= Shank length, DSL= Drumstick length, NTS= Nose to shoulder, WGL= Wing length, CIR= Circumference

Table 5: Interactions between strain and sex on morphometric parameters of experimental birds at the starter phase

AGE	STRAIN	PRT SEX	BWT (g)	BRG (cm)	TRL (cm)	STL (cm)	SHL (cm)	DSL (cm)	NTS (cm)	WGL (cm)	CIR (cm)
1	COBB	M	93.78	7.32	6.97	7.41	3.09	5.69	6.89	7.86	12.22
		F	91.32	7.43	7.08	7.58	3.13	5.47	6.66	7.69	12.27
	AA	M	139.98	7.42	7.39	8.10	3.31	5.83	6.92	7.88	12.45
		F	141.75	7.45	7.40	8.18	3.40	5.78	6.93	7.87	12.40
		±SEM	2.43	0.16	0.16	0.16	0.06	0.11	0.24	0.17	0.11
		P-VALUE	0.40	0.80	0.77	0.77	0.71	0.44	0.62	0.64	0.65
2	COBB	M	206.92	9.27	8.69[c]	9.90[c]	3.67	6.70	9.30	10.81	13.71
		F	205.73	9.34	8.70[c]	9.90[c]	3.65	6.55	9.50	11.01	13.94
	AA	M	327.36	10.94	10.58[a]	11.75[a]	3.88	7.59	9.43	11.96	17.30
		F	320.42	10.78	9.61[b]	10.83[b]	3.90	7.69	9.33	11.71	17.07
		±SEM	5.79	0.24	0.21	0.21	0.07	0.13	0.22	0.25	0.32

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		P-VALUE	0.63	0.63	0.03	0.04	0.80	0.34	0.49	0.39	0.49
3	COBB	M	444.81	11.91	11.96	13.31	4.59	8.92	10.92	14.03	18.18
		F	426.37	11.71	11.69	13.01	4.50	9.01	10.77	14.14	17.99
	AA	M	561.70	13.01	12.16	13.47	4.95	7.84	10.51	13.58	17.23
		F	555.82	12.89	12.03	13.61	4.73	7.81	10.32	13.33	17.03
		±SEM	16.53	0.19	0.13	0.18	0.13	0.14	0.12	0.21	0.20
		P-VALUE	0.71	0.84	0.62	0.23	0.64	0.67	0.83	0.41	0.98
4	COBB	M	689.01	13.77	13.40	15.04	4.95	10.78	12.34	16.59	20.80
		F	649.20	13.90	13.58	15.06	4.88	10.79	12.04	16.39	20.42
	AA	M	832.42	14.03	14.32	15.97	5.10	11.31	12.26	17.06	23.24
		F	766.59	13.83	13.81	15.41	5.00	10.94	12.17	16.75	22.28
		±SEM	23.11	0.18	0.22	0.23	0.05	0.17	0.15	0.16	0.25
		P-VALUE	0.58	0.37	0.13	0.23	0.74	0.29	0.52	0.75	0.27

[a, b, c] =means in the same column bearing different superscripts are significantly different ($p<0.05$), PRT = Parameter, SEM= Standard error of mean, P Value= Level of significance, AA= Arbor Acre, Cobb= Cobbs-500, M=Male, F= Female, BWT= Body weight, BRG= Breast girth, TRL= Trunk length, STL= Shoulder to tail, SHL= Shank length, DSL= Drumstick length, NTS= Nose to shoulder, WGL= Wing length, CIR= Circumference

Table 6: Interactions between strain and sex effect on morphometric parameters of experimental birds at finisher phase

AGE	STRAIN	PRT SEX	BWT (g)	BRG (cm)	TRL (cm)	STL (cm)	SHL (cm)	DSL (cm)	NTS (cm)	WGL (cm)	CIR (cm)
5	COBB	M	963.16	16.15	16.23[b]	18.02	5.39	12.59	12.82	18.23	24.13
		F	885.24	15.35	16.03[b]	17.77	5.24	12.44	12.61	17.86	23.39
	AA	M	1230.96	14.97	17.58[a]	19.12	5.45	14.00	13.78	15.41	25.48
		F	1118.77	14.99	16.48[b]	18.15	5.33	13.53	13.32	16.11	25.16
		±SEM	27.25	0.21	0.21	0.22	0.03	0.12	0.17	0.46	0.18
		P-VALUE	0.54	0.06	0.04	0.12	0.63	0.18	0.46	0.26	0.25

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6	COBB	M	1342.95	17.97	16.94	19.09	5.90	13.60	14.51	18.90	26.13
		F	1238.50	17.12	16.87	18.64	5.78	13.10	14.37	17.80	25.02
	AA	M	1713.18	18.82	18.41	20.85	5.78	14.69	14.02	19.15	30.75
		F	1608.49	18.18	17.56	19.63	5.80	14.33	13.78	19.36	30.18
		±SEM	23.72	0.32	0.25	0.33	0.03	0.19	0.12	0.47	0.29
		P – VALUE	1.00	0.74	0.13	0.26	0.06	0.74	0.70	0.18	0.37
7	COBB	M	1621.67	19.50	18.25	20.80	6.34	14.85	15.75	24.33	30.78
		F	1599.68	18.82	18.78	21.30	6.29	14.53	15.91	21.00	30.50
	AA	M	1776.44	19.52	17.34	19.83	6.24	15.54	15.86	21.21	29.84
		F	1740.17	19.29	16.76	19.13	6.33	15.69	15.86	21.01	29.73
		±SEM	47.27	0.23	0.28	0.31	0.06	0.19	0.25	1.28	0.40
		P-VALUE	0.88	0.33	0.06	0.07	0.28	0.25	0.76	0.24	0.84
8	COBB	M	2132.09	30.44	19.41	22.28	6.96	16.16	15.95	22.82	32.72
		F	2111.99	20.19	20.07	22.58	7.44	15.89	15.67	22.82	32.62
	AA	M	2044.56	20.50	18.93	21.50	6.71	16.03	15.56	22.18	32.12
		F	2016.67	20.48	19.46	22.30	6.59	16.68	16.00	21.95	31.93
		±SEM	78.92	4.54	0.31	0.30	0.31	0.24	0.25	0.33	0.39
		P-VALUE	0.96	0.27	0.82	0.41	0.34	0.07	0.17	0.73	0.91

$^{a,\ b,\ c}$ =means in the same column bearing different superscripts are significantly different ($p<0.05$), PRT = Parameter, SEM= Standard error of mean, P Value= Level of significance, AA= Arbor Acre, Cobb= Cobbs-500, M=Male, F= Female, BWT= Body weight, BRG= Breast girth, TRL= Trunk length, STL= Shoulder to tail, SHL= Shank length, DSL= Drumstick length, NTS= Nose to shoulder, WGL= Wing length, CIR= Circumference

CONCLUSION

This study provided valuable insights into the effects of strain and sex on the morphometric traits of broiler chickens during the starter and finisher phases of production. The findings revealed significant variations in body weight, breast girth, trunk length, shoulder-to-tail length, shank length, drumstick length, nose-to-shoulder length, wing length, and circumference among the two strains and sexes. It can be concluded that strain significantly influenced key phenotypic parameters, with Arbor-Acre birds consistently exhibiting superior

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body weight and linear body measurements compared to Cobb-500 birds. These differences can be attributed to genetic factors inherent to each strain, influencing their growth potential and feed efficiency. Additionally, significant differences in breast girth, trunk length, and other body dimensions suggested that strain-specific growth patterns should be considered when selecting breeding stock for optimal performance.

Male broilers generally displayed larger body sizes and higher growth rates than their female counterparts, especially in terms of body weight, breast girth, and trunk length. These sex-based differences are likely influenced by hormonal factors and genetic predispositions. Therefore, sexual dimorphism was evident, with male birds generally exhibiting higher body weights and certain linear measurements compared to females, particularly in the later stages of growth. However, the magnitude of these differences varied across the experimental weeks and phases, highlighting the importance of considering sex as a factor in broiler management. The interaction between strain and sex revealed that strain had a greater influence on morphometric traits than sex during both the starter and finisher phases. Overall, these findings emphasize the need for careful selection of broiler strains and consideration of sex differences in breeding and management practices to enhance growth rates, optimize meat production, and improve profitability. Understanding these phenotypic variations is crucial for breeders and farmers to select optimal strains that align with specific production goals. Tailoring nutritional strategies and management practices to the specific needs of different strains and sexes can further optimize growth and performance.

RECOMMENDATION

For optimal early growth and potential profit, the Arbor-Acre broiler strain is recommended for the starter phase based on the result of this study for high-yield meat production. However, both strains can be raised to eight weeks to achieve similar final weights and profitability. Further research is needed to explore the underlying genetic mechanism and environmental factors that contribute to these phenotypic differences. Additionally, investigating the impact of dietary interventions and different rearing conditions on the morphometric traits of broiler chickens would provide valuable insights as well as their implications for long-term production strategies in the poultry industry. By considering the factors influencing phenotypic variation, the poultry industry can adopt more effective breeding and management practices to improve the overall productivity and profitability of broiler chicken production.

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