Influence of location and sex on the body weight and linear body measurements of pigs in Kaduna State, Nigeria

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ABSTRACT

Aim: Purpose of the study was to breeds to assess the influence of location and sex on the body weight and linear body measurements of pigs in Kaduna State, Nigeria.

Method and materials: Body weight and morpho-biometric studies were conducted on 500 mixed breed of pigs' comprising Yorkshire, Duroc, Large White and Hampshire breeds. The body weight and biometric traits taken include body weight, body length, chest girth, ear length, foreleg length, head length, height at wither, hind leg length and were analyzed using Statistics analysis software.

Results: The results showed that location had significant (P<0.05) effect in all the parameters except on chest girth and foreleg length. The results for sex indicated that sex had significant (P<0.05) effect on the body weight and linear body measurements of pigs with male having significantly (P<0.05) higher values for body weight, body length, height at wither and hind leg length compared to female pigs. The results revealed that location × sex interaction had no significant (P>0.05) effect in the body weight and all the linear body measurements (body length, chest girth, ear length, foreleg length, head length, height at wither, hind leg length). In conclusion, location significantly influenced most body measurements except chest girth and foreleg length, while sex significantly affected body weight and several linear measurements with males showing higher values, and there was no significant interaction between location and sex on any measured traits.

Conclusion: It was concluded location significantly affected most body measurements of pigs except chest girth and foreleg length, while sex significantly influenced body weight and several linear body measurements, with males exhibiting higher values than females; however, there was no significant interaction between location and sex on any of the traits measured.

Keywords: Body weight, linear body measurements, location, pigs

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Introduction

Pig production in Nigeria, particularly in Kaduna State, is a significant agricultural activity, with local and mixed breeds reared across various local government areas. Accurate assessment of body weight and linear body measurements-such as body length, chest girth and height at withers-is essential for effective management, selection, and marketing of pigs, especially in regions where access to weighing scales is limited (Mallam *et al.*, 2024). Studies involving 500 pigs from five local government areas (Kaura, Chikun, Jaba, Zango-Kataf and Jema'a) demonstrated that both environmental factors associated with location and biological factors such as sex can significantly affect body weight and linear measurements (Mallam *et al.*, 2024). Variations in management practices, feed availability, and local environmental conditions across these areas contribute to differences in growth and body conformation among pigs (Mallam *et al.*, 2024).

Sex also plays a crucial role, as male and female pigs often exhibit distinct patterns in body size and growth rates-a trend observed in other livestock species as well (Egena *et al.*, 2010). Understanding these effects is vital for breeders and farmers aiming to optimize productivity and genetic improvement programs. While some studies indicate sex affects post-weaning weight (Paredes *et al.*, 2012) others report no significant sex-based differences in body measurements. This discrepancy may depend on breed or management practices. Birth season impacts growth rates, likely

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due to temperature or feed availability (Paredes *et al.*, 2012).

Regional variations in management, feed quality, and climate contribute to weight differences. Location influences the body weight and linear body measurements of pigs in Kaduna State due to differences in management practices, environmental conditions, and feed availability across local government area (Mallam et al., 2024). Sex also plays a significant role, as male and female pigs often exhibit distinct growth rates and body conformations, which can affect their body weight and morphometric traits. Understanding these effects is crucial for optimizing selection, management, and productivity strategies in pig farming within the region. Therefore, investigating the impact of location and sex on body weight and linear body measurements provides valuable insights for enhancing pig production efficiency in Kaduna State.

Materials and Methods

Study area and experimental animals: The study was conducted in five local government areas within Kaduna State, namely Kaura, Chikun, Jaba, Zangon-Kataf and Jema'a local government areas. A total of 500 pigs of between 3-4 months of age representing different breeds including Yorkshire, Duroc, Large White and Hampshire, were measured for various parameters, with a sample size of 100 pigs selected each of the mentioned local government areas from farms. Pigs sampled were reared intensively were supplied with water and feed *ad libitum*. Routine vaccination and medications were administered as at when due.

Parameters measured: Following parameters were measured; Body weight (BW), body length (BL), chest girth (CG), and height at wither (HW), ear length (EL), head length (HL), foreleg length (FLL), and hind leg length (HLL).

BW= Body weight estimation was carried out using a hanging scale to determine weight of each animal accurately.

BL= Body length was measured as distance between the occipital protuberance and the tail drop, ensuring precise alignment during measurement.

CG= Chest girth was determined as the circumference of the chest just behind the forelimbs, meticulously recorded using a measuring tape.

HW= Height at wither was measured as the distance between the most dorsal point of the withers and the ground, ensuring a consistent angle of measurement to maintain accuracy.

Ear length (EL), head length (HL), foreleg length (FLL), and hind leg length (HLL) were assessed using a measuring tape.

To minimize variations in measurements, all assessments were consistently carried out by same person, ensuring accuracy and reducing potential discrepancies arising from inter-personnel variations.

Data collected on body weight and linear body measurements were assess for the effects of location and sex using statistics software and means were compared using Duncan Multiple Range Test.

Results and Discussion

The effect of location on the body weight and linear body measurements of pigs was noticed (Table 1). The results showed that location had significant (P<0.05) effect in all the parameters except on chest girth and foreleg length. The Zangon-Kataf had significant (P<0.05) higher values compared to other locations except for chest girth where that of Zangon-Kataf was similar to that of Jema'a. For ear length, Jema'a had significant (P<0.05) higher value but similar to Chikun.

The finding that location significantly affected most parameters suggested that environmental factors, management practices, and possibly genetic differences among pig populations in different areas contribute to variations in body size and conformation. These findings were in alignment with previous studies indicating that linear body measurements and body weight in pigs can be influenced by external factors such as management, nutrition, and local adaptation (Sungirai *et al.*, 2014). The significant differences observed across locations, except for chest girth and foreleg length, imply that these two traits may be less sensitive to environmental variation or are under stronger genetic control.

Pigs from Zangon-Kataf exhibited significantly higher values in most parameters compared to other locations, except for chest girth, where their values were similar to those from Jema'a. This suggested that pigs in Zangon-Kataf may benefit from more favorable conditions or genetic stock that promotes better growth and development. The lack of a significant difference in chest girth between Zangon-Kataf and Jema'a could indicate similar management practices or environmental conditions affecting this particular trait in both locations, or that chest girth is a more conserved trait across populations which aligned with the findings of Sungirai *et al.* (2014). The variation in ear length could be attributed to genetic differences between the pig populations or local adaptation to environmental conditions, such as temperature regulation. Ear length is known to vary among pig breeds and can be influenced by both genetic and environmental factors (Baruzzi *et al.*, 2023). The significant location effect on most body measurements underscores the importance of considering local environmental and management conditions when evaluating pig growth and productivity. The exceptions-chest girth and foreleg length-may serve as stable indicators for certain aspects of pig conformation, less affected by external factors.

Effect of sex on body weight and linear body measurements of pigs was presented (Table 2). The results indicated that sex had significant (P<0.05) effect on the body weight and linear body measurements of pigs. Male had significantly (P<0.05) values for body weight, body length, height at wither and hind leg length compared to female pigs.

Males typically grow faster and attain larger body sizes than females, primarily due to hormonal differences, particularly higher levels of testosterone, which promote muscle growth and skeletal development. This physiological advantage often results in males having greater body weight and larger body dimensions (Yao et al., 2009). The significantly greater body length, height at wither, and hind leg length in males suggest that sexual dimorphism is evident in the studied pig population. These traits are important indicators of growth performance and overall physical development (Egena et al., 2019). The larger frame and heavier weight of male pigs may also be advantageous for certain production purposes, such as meat yield (Egena et al., 2019). These findings were in alignment with previous research, which has consistently reported that male pigs tend to outperform females in terms of growth rate and body measurements. For instance, studies have shown that male pigs generally have higher average daily gains and reach market weight faster than females, making them more desirable for commercial production (Vázquez-Gómez et al., 2020). The significant effect of sex on growth traits highlights the importance of considering sex as a factor in pig management, breeding programs, and performance evaluation. Producers may need to adopt different management strategies for males and females to optimize growth and productivity.

For example, nutritional requirements and housing conditions might be adjusted to accommodate the faster growth and larger size of males.

It revealed the location × sex interaction effects on the body weight and linear body measurements of pigs (Table 3). The results revealed that location × sex interaction had no significant (P>0.05) effect in the body weight and all the linear body measurements (body length, chest girth, ear length, foreleg length, head length, height at wither, hind leg length).

The lack of a significant interaction suggests that the combined influence of location and sex on pig body weight and body measurements is minimal or negligible. In other words, the effect of sex on these traits does not depend on the location, and vice versa. Since location and sex do not interact significantly, it implies that management practices or genetic selection based on sex can be applied consistently across different locations without expecting differential growth or body conformation responses. This simplifies decisionmaking for breeders and farmers who operate in multiple locations. The locations studied might have similar environmental factors (e.g., climate, feed availability), reducing location-specific effects. The pig populations across locations might be genetically similar, leading to consistent growth patterns regardless of location. It is also possible that the sample size or variability within groups was insufficient to detect subtle interaction effects. The results indicate that location and sex independently affect pig body weight and linear measurements body without interacting significantly. This suggests that breeding and management strategies can be designed considering sex and location separately, without the need to account for complex interaction effects

between these two factors. The no significant difference obtained agreed with the findings of Morenikeji *et al.* (2019) found that genotype-sex interactions had no significant (P>0.05) effect on most linear measurements at different stages of pig growth. This suggested that the effect of sex on these traits does not depend on genotype (or, by analogy, location), and vice versa. The absence of significant interaction effects means that management and selection strategies based on sex can be applied consistently across different locations or genotypes without expecting differential responses in growth or body conformation.

Table 1: Effect of location on the body weight and linear body measurements of pigs

	Location								
Parameters	Chickun	Jaba	Jema'a	Kaura	Zangon-Kataf	P-value			
Body weight (Kg)	27.85±3.16 ^d	38.73±3.18°	40.18±3.18 ^b	33.46±3.17°	50.51±3.45ª	0.0000*			
Body length (cm)	69.15±2.18 ^c	76.12±2.19 ^b	77.75±2.19 ^b	71.97±2.19 ^b	88.28±2.19 ^a	0.0000*			
Chest girth (cm)	65.57±21.17°	71.71±21.28 ^b	85.63±21.28 ^a	67.97±21.28 ^c	83.67±21.28 ^a	0.0464^{NS}			
Ear length (cm)	21.66±0.03 ^a	18.78±0.03 ^b	22.31±0.02 ^a	17.57±0.01 ^b	19.94±0.02 ^b	0.0000*			
Foreleg length (cm)	32.53±9.74	36.39±9.74	35.59±4.74	32.72±9.74	37.89±9.79	0.4359 ^{NS}			
Head length (cm)	26.93±0.03 ^b	28.53±0.04 ^b	27.21±0.02 ^b	26.01±0.01 ^b	31.11±0.03 ^a	0.0000*			
Height at wither (cm)	52.74±1.53 ^b	57.33±1.54 ^b	56.95±1.54 ^b	52.89±1.52 ^b	71.39±1.55 ^a	0.0000*			
Hind leg length (cm)	38.35±1.01 ^b	43.96±1.01ª	42.99±1.01ª	40.10 ± 1.10^{b}	44.28±1.01ª	0.0000*			

abcMeans with different superscripts across the row differs significantly (P<0.05)

Table 2: Effect of sex on the body weight and linear body measurements of pigs

	Sex		
Parameters	Male	Female	P-value
Body weight (Kg)	42.52±2.05 ^a	33.76±1.96 ^b	0.0002*
Body length (cm)	80.24±1.41ª	73.03±1.35 ^b	0.0003*
Chest girth (cm)	75.85±13.76	85.97±13.14	0.5983 ^{NS}
Ear length (cm)	20.53±0.03	19.58±0.03	0.1114^{NS}
Foreleg length (cm)	36.35±6.32	41.70±6.02	0.5436 ^{NS}
Head length (cm)	28.54±0.02	27.39±0.01	0.0522^{NS}
Height at wither (cm)	60.15±0.02 ^a	56.37±0.01 ^b	0.0067*
Hind leg length (cm)	43.17±0.04ª	40.70±0.01 ^b	0.0071*

^{ab}Means with different superscripts across the row differs significantly (P<0.05)

Table 3: Location ×	sex interaction	effects on	the body	weight and	linear body	v measurements of t	pigs
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Chikun			Jaba		Jema'a		Kaura	Z/Kataf			
Paramete	ers Male	Female	e Male	Female	e Male	Female	e Male	Female	Male	Female	P-value
BW(Kg)	31.79±4.58	23.91±4.36	41.99±4.28	35.48±4.73	32.26±4.28	32.26±4.24	35.36±4.32	31.56 ± 4.68	55.44±5.15	45.58±4.03	0.7353 ^{NS}
BL(cm)	72.46±3.16	65.85±3.00	78.62±2.95	73.62±3.26	84.25±3.30	71.25±2.95	74.39±2.98	69.54±3.25	91.50±3.55	84.90±2.78	0.6795 ^{NS}
CG(cm)	69.79±3.71	61.34±2.92	74.22±2.86	69.18±3.71	79.00±3.07	75.27±2.87	70.00±2.89	65.93±3.13	86.24±3.51	81.11±2.70	0.6061 ^{NS}
EL(cm)	22.40±0.95	20.92 ± 0.91	18.47 ± 0.98	19.00 ± 0.89	23.14±0.10	21.48 ± 0.88	17.87±0.90	17.26±0.97	20.13±0.11	19.74±0.84	0.9471 ^{NS}
FLL (cm)	34.02±1.42	31.04 ± 1.38	37.11±1.31	35.67±1.52	37.98±1.40	37.20 ± 1.14	31.96±1.47	33.48±1.32	39.16±1.58	36.63±2.37	0.5758 ^{NS}
HL (cm)	27.75±0.95	26.11±0.91	28.62±0.98	28.44 ± 0.89	28.25±0.99	26.18 ± 0.88	26.63±0.90	25.39±0.97	31.66±1.07	30.63±0.84	0.8006 ^{NS}
HW (cm)	55.98±2.22	49.51±2.11	59.15±2.08	55.51 ± 2.29	54.05±2.08	59.84±2.32	54.02±2.09	51.76±2.27	71.02±1.95	71.75±2.50	0.6722 ^{NS}
HLL (cm))39.94±1.48	36.77±1.34	44.95±1.37	42.98±1.51	44.86±1.53	41.11±1.35	40.59±1.38	39.61±1.49	40.59±1.38	43.03±1.29	0.8929 ^{NS}

BW=Body weight, BL=Body length, CG=Chest girth, EL= Ear length, FLL=Foreleg length, HL=Head length, HW= Height at wither, HLL=Hind leg length, Z= Zangon, NS=Not significant.

It simplified decision-making for breeders and farmers operating in multiple environments (Morenikeji *et al.*, 2019). The lack of interaction may be due to similar environmental conditions (such as climate or feed availability) across locations, or genetic similarity among pig populations, which can reduce location-specific effects and lead to consistent growth patterns. The low variability within groups may also contribute to the inability to detect subtle interaction effects, as noted in studies where no significant sex or interaction effects were observed.

Conclusion

It was concluded that location significantly affected most body measurements of pigs except chest girth and foreleg length, while sex significantly influenced body weight and several linear body measurements, with males exhibiting higher values than females; however, there was no significant interaction between location and sex on any of the traits measured.

It is advisable to tailor breeding and management strategies by considering the independent effects of location and sex to enhance pig growth performance, as their interaction does not significantly impact body weight or linear body measurements.

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