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Effects of Genotype X Sex Interaction on Growth and Some Development Characteristics of Ross and Anak Broiler Strains in the High Rainforest Zone of Nigeria

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Abstract: A total number of two hundred broilers of mixed sexes comprising of one hundred Ross and one hundred Anak broiler strains was assessed for body weight (BWT), body girth (BDG), keel length (KLL) and shank length (SHL) from day-old to 9 weeks of age. Differences in BWT, BDG, KLL and SHL between the two genotypes were significant ($p<0.05$) at all ages except BWT at 3 weeks, BDG at 6 weeks and SHL at 9 weeks of age. Significant sexual dimorphism existed between both sexes and genotypes. Male broilers were also superior to the females in all growth traits in the Ross genotype whereas Anak genotype only exhibited superiority of the males over the females in BWT at 9 weeks, BDG at 6 and 9 weeks and SHL at 9 weeks of age. The Ross broiler strain was significantly ($p<0.05$) heavier than the Anak broiler at 6 and 9 weeks of age. This difference in weight is an indication, therefore that genetic difference existed in growth rates between the two commercial strains studied. This could form reliable bases for further studies and effective selection for meat yield between Ross and Anak broiler for further improvement.

Key words: Broiler strains, sexual dimorphism, genetic differences

INTRODUCTION

Animal growth refers to an increase in linear body size, accumulation of adipose tissue and retention of nitrogen and water with age and development from conception to maturity. Growth can also be caused by cell division, increase in cell size or deposition of extra curricular material (Edey, 1983). Growth is usually measured by weight gain per day (growth rate), degree of maturity, maturing rate and body weight at a given age. Body weight at a specific age is probably the most frequently used indicator of growth (Chambers, 1990). Muscular growth in chicken after hatching is the result of an increase in size of the muscle cells (Hypertrophy), as basically all cell division takes place during embryonic development (Hyperplasia). Growth rates in birds have been categorized into two levels-high and low growth capacity (Lilja, 1983). The result from his experiment revealed that a high growth capacity is characterized by a rapid early development of the digestive organs and the liver whereas a low growth rate is characterized by a rapid early development of the pectorals and feathers. Several studies have shown that differences in growth pattern are under genetic control and that variation exists within species (Lilja *et al*., 1985; Carborg *et al*., 2003).

As selection for growth rate over the decades has proved successful, it has been practicable successively to reduce the age at slaughter from about twelve weeks down to

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nine weeks or less. There is evidence that there are genetic differences in growth rate between strains and the changes in weight ranking may be critical in the age ranged between eight to twelve weeks (Deeb and Lamont, 2002). Selection for breast muscle yield and body weight in commercial broilers has resulted in genotypes far different from broilers processed in the past (Reddish and Lilburn, 2004). There is also the problem of weight differential between sexes which increases as the mean weight of both sexes increases. The objective of the present experiment was to investigate the effect of genotype by sex interaction, sex and genotype on growth and some development characteristics of two commercial broiler lines exhibiting similar rates of body weight gain based on a percentage of 9 weeks body weight.

MATERIALS AND METHODS

The experiment was conducted at the Teaching and Research Farm of the Rivers State University of Science and Technology, Port Harcourt, Nigeria between June and August, 2006. Two hundred broilers of mixed sexes comprising of 100 Ross and 100 Anak broiler strains were wing-tagged and fed *ad-libitum* with commercial broiler starter diet which contains 22-25% Crude Protein (CP) from day old to 5 weeks of age and commercial broiler finisher diet which contains 20% CP from 5-9 weeks of age. Clean water was supplied throughout the experimental period. Adequate floor and feeding spaces and vaccines were also provided.

Growth traits measured were body weight (BWT), body girth (BDG) keel length (KLL) and shank length (SHL). Measurements of growth traits were taken on the birds at an interval of 3 weeks (i.e., 0, 3, 6 and 9 weeks of age) early in the morning before feeding the birds. Body weight of individual birds was taken with a top loading scale in grams and corrected to two places of decimal. Body girth, keel length and shank length were measured in centimeters using a tape rule.

Statistical Analysis

Data were subjected to a two way analysis of variance using the General Linear Model (GLM) of SAS (1999). The model generated was fitted for the effects of genotype and sex and their interaction:

$$Y_{ijk} = \mu+G_i+S_j+(GS)_{ij}+e_{ijk}$$

where, Y is the dependent variable, μ is the grand mean, G_i is the fixed effect of the genotype (i = 1,2); S_j is the fixed effect of the sex (j = 1, 2); $(GS)_{ij}$ is the interaction between genotype and sex and e_{ijk} is the random error term.

RESULTS AND DISCUSSION

The day old body weight of Ross broiler was significantly higher ($p<0.05$) than Anak broiler (38.8 versus 35.9 g, respectively). Both breeds have similar body weight at 3 weeks of age, while significant ($p<0.05$) breed differences were observed at 6 and 9 weeks of age (Table 1). Ross broiler was heavier than their Anak counterpart at 6 and 9 weeks of age. Body girth, keel length and shank length were significantly higher ($p<0.05$) for Anak broiler at day old and 3 weeks of age than Ross broiler (Table 1) but the later showed superiority over the former at the 6 and 9 weeks of age for body girth and shank length.

The effect of sex on the growth parameters are presented in Table 2. Significant sexual dimorphism was realized between males and females for BWT at day-old, 3, 6 and 9 weeks; BDG at 3, 6 and 9 weeks; KLL at day-old, 6 and 9 weeks and SHL at 6 and 9 weeks of age respectively. The genotypes x sex interaction are presented in Fig. 1-4. The interaction effect was significant for SHL at day-old; BDG and SHL at 3 weeks; BDG, SHL, KLL and BWT at 6 weeks and SHL at 9 weeks of age respectively.

Table 1: Effect of genotype on growth traits of broilers at 0, 3, 6 and 9 weeks of age

	Day old		3 weeks	
Traits	Ross	Anak	Ross	Anak
BWT	38.80±0.45^{a}	35.90±0.18^{b}	310.00±9.14^{a}	305.00±8.20^{a}
BDG (cm)	7.95±0.01^{b}	8.04±0.01^{a}	16.80±0.13^{b}	18.20±0.16^{a}
KLL (cm)	1.97±0.01^{b}	2.01±0.01^{a}	6.76±0.01^{b}	10.60±0.46^{a}
SHL (cm)	2.34±0.01^{b}	2.39±0.01^{a}	3.63±0.01^{b}	4.46±0.03^{a}
	6 weeks		9 weeks	
Traits	Ross	Anak	Ross	Anak
BWT	1458.00±23.80^{a}	1370.00±23.50^{b}	2820.00±48.90^{a}	2321.00±89.40^{b}
BDG (cm)	28.30±0.14^{a}	28.10±0.16^{a}	36.60±0.19^{a}	33.50±0.20^{b}
KLL (cm)	12.80±0.16^{b}	14.80±0.20^{a}	17.00±0.18^{a}	16.20±0.13^{b}
SHL (cm)	7.45±0.06^{a}	7.26±0.09^{a}	9.73±0.09^{a}	8.92±0.11^{b}

Data are expressed as Mean±SE. Within each age, means in the same row having different superscripts differed significantly ($p<0.05$), BWT: Body weight, BDG: Body girth, KLL: Keel length and SHL: Shank length. Number of observation for Anak broiler strain was only 99 at 6 and 9 weeks of age because of mortality while all other ages are 100

Table 2: Effect of sex on growth traits of Ross and Anak broiler genotypes at 0, 3, 6 and 9 weeks of age

	Day old		3 weeks		6 weeks		9 weeks	
Traits	Male	Female	Male	Female	Male	Female	Male	Female
Body weight (g)	36.3±0.47^{a}	34.5±0.27^{b}	294±6.53^{b}	319±9.88^{a}	1468±27.1^{a}	1364±19.3^{b}	2841±93.9^{a}	2321±43.7^{b}
Body girth(cm)	8.00±0.02^{a}	7.99±0.01^{a}	17.7±0.12^{a}	17.3±0.21^{b}	28.4±0.16^{a}	28.0±0.13^{b}	35.8±0.28^{a}	34.4±0.27^{b}
Keel length (cm)	2.02±0.01^{a}	1.96±0.01^{b}	8.50±0.42^{a}	8.83±0.42^{a}	14.0±0.19^{a}	13.5±0.25^{b}	17.0±0.13^{a}	16.2±0.17^{b}
Shank length(cm)	2.35±0.01^{a}	2.37±0.01^{a}	4.08±0.05^{a}	4.02±0.07^{a}	7.52±0.09^{a}	7.20±0.06^{b}	9.76±0.12^{a}	8.92±0.08^{b}

Within each age, means occupying same row with different superscripts differed significantly ($p<0.05$)

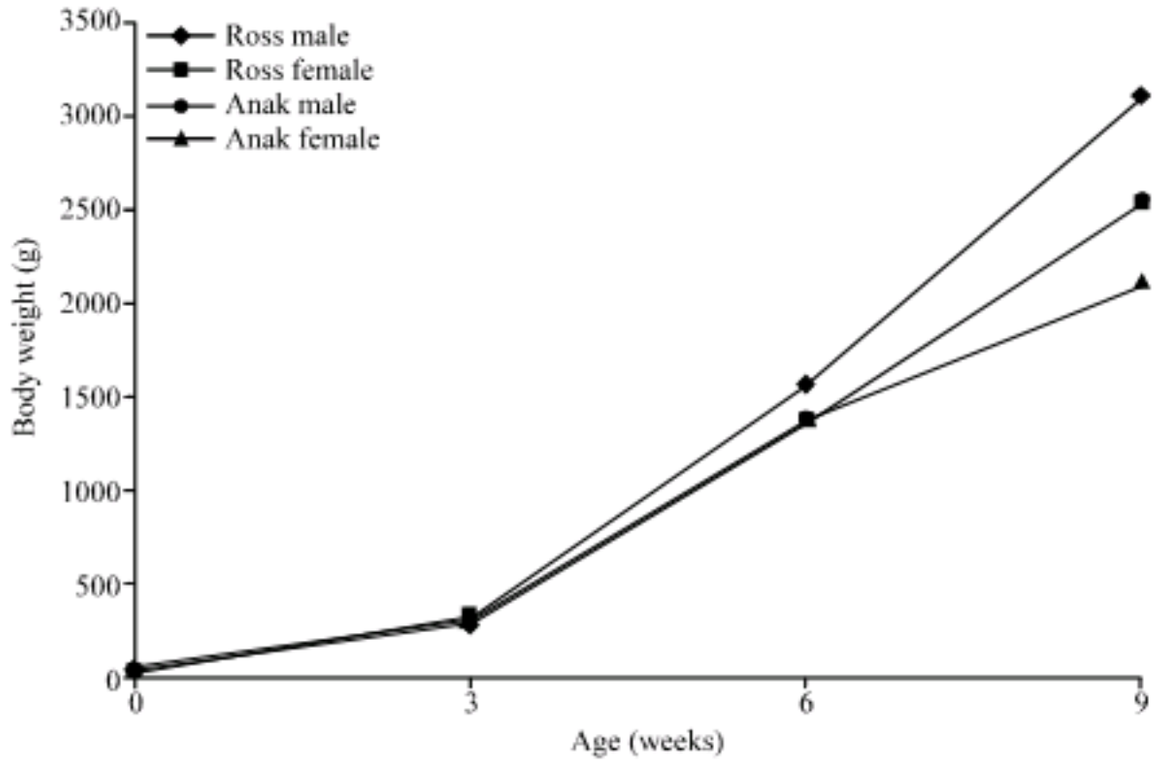

Fig. 1: Effect of genotype by sex interaction on body weight of Ross and Anak broiler strain from day-old to 9 weeks of age

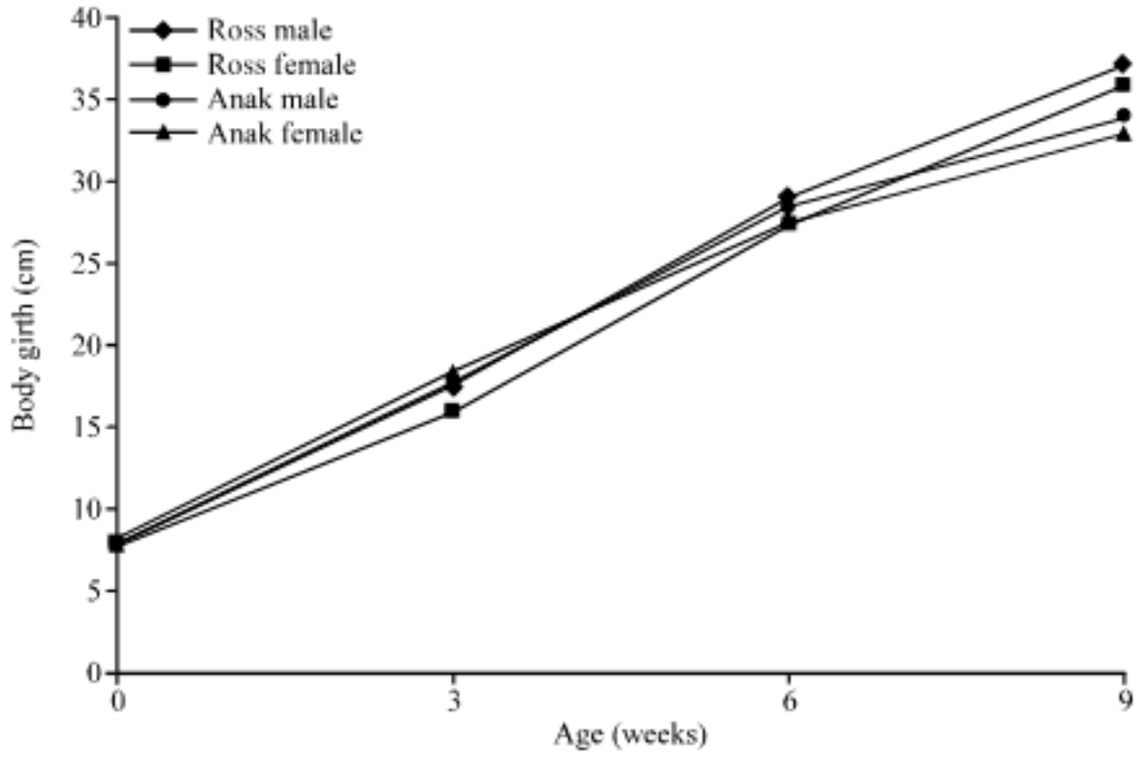

Fig. 2: Effect of genotype by sex interaction on body girth of Ross and Anak broiler strains from day-old to 9 weeks of age

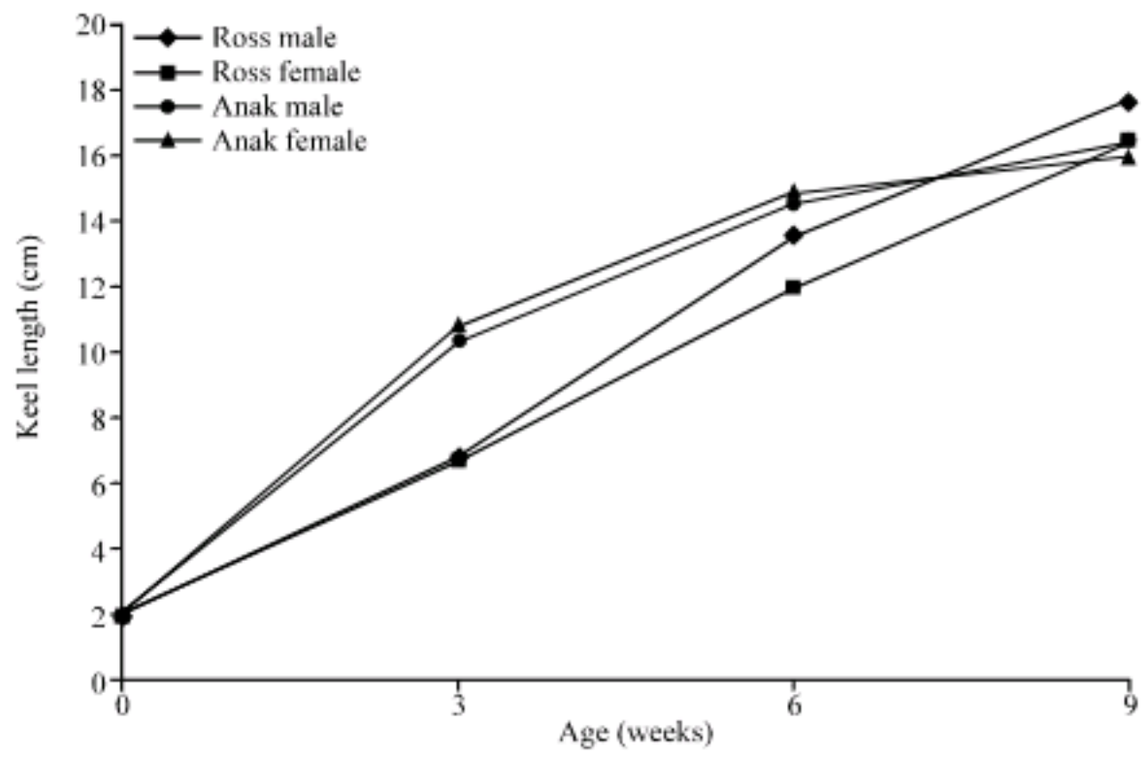

Fig. 3: Effect of genotype by sex interaction on keel length of Ross and Anak broiler strains from day old to 9 weeks of age

The difference observed in growth rate for both breeds is an indication that there is variation in their growth pattern. This result is consistent with earlier reports of differences in growth pattern within species (Deeb and Lamont, 2002). While, the Anak broiler exhibit an initial faster growth of body parts with a slower growth of the same at the finishing stage. The Ross broiler on the other hand combines an initial slower growth of body parts with a rapid growth at the finishing stage. This result corroborates the findings of Lilja (1983) that growth rates in birds vary in capacities.

The male were generally superior to females of both Ross and Anak in BWT at all ages except 3 weeks where the females of both breeds excelled the males in body weight. The significant sex effect on body weight is in agreement with literature (Laseinde and Ajewole,

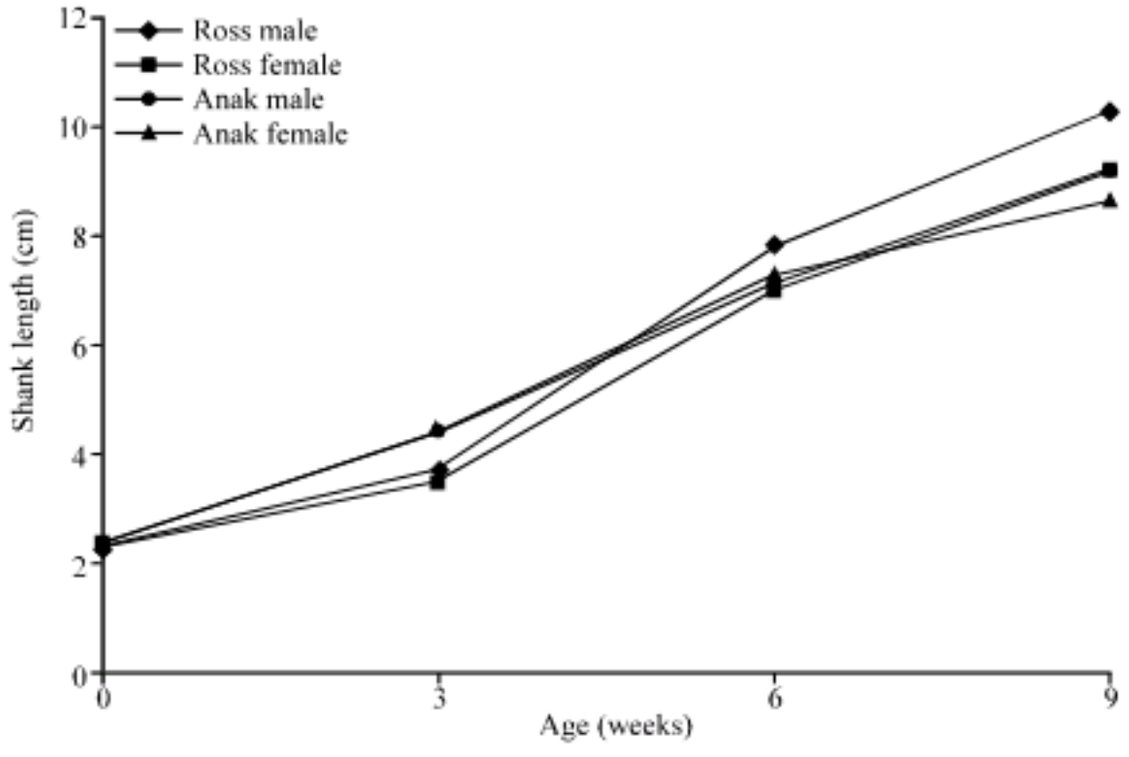

Fig. 4: Effect of genotype by sex interaction on shank length of Ross and Anak broiler strains from day-old to 9 weeks of age

1999; Ajayi and Ayorinde, 2000; Deeb and Cahaner, 2001; Adedeji *et al*., 2004; Haitook, 2006). The superiority of the males could be as a result of their ability to dominate while feeding and hormonal differences resulting in faster deposition of muscles in males than in the female birds. Moreover, the phenotypic distributions for BWT of the contemporary meat-type chicken population and its ancestors 50 years ago do not overlap, indicating that intensive selection accomplished more than simply increasing the frequency of the desired genotypes, but rather produced new genotypes with levels of performance much beyond their ancestors (Havenstein *et al*., 1994; Deeb and Lamont, 2002).

Body parts also increased as body weight increases. This observation of sexual dimorphism for growth of body parts is in agreement with common knowledge. Positive correlation has been reported for body weight-body parts relationship in Cobb broiler strains (Ajayi and Ayorinde, 2000).

CONCLUSION

Based on the result of this study, Ross male broiler is slightly higher than their Anak male broiler counterpart in growth assessment. The result may therefore form reliable based for further studies and effective selection for meat yield between Ross and Anak broiler for further improvement.

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