

EFFECT OF GENOTYPE AND SEX ON PRE-WEANING BODY WEIGHT AND CARCASS TRAITS OF PIGS

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ABSTRACT

Records of weekly body weight and carcass characteristics of sixty (60) pigs farrowed by two boars (Large White and indigenous dihybrid Large Black), two indigenous dihybrid Duroc sows, two indigenous dihybrid Large Black sows and four Large White sows kept at Teaching and Research Farm, Federal University of Agriculture were used for this study. There was no sex effect ($P > 0.05$) on the pre-weaning weekly body weight of the piglets at early weeks, except at weeks 6 to 8. Genotype effect on weekly body weight was significant ($p < 0.05$) at week one. And its effects were also significant on loin eye area and uterus weight while sex effect was observed on backfat, kidney weight and stomach weight. Genotype and sex have significant effects on pre-weaning body weight and carcass characteristics.

INTRODUCTION

Animal growth can be defined as the increase in size and changes in functional capability of the various tissues and organs of animals that occurs from conception through maturity. It is an important characteristic in animal production and it determines the rate of progress made most especially in pig production. This has been attributed to an increase in size and development, and has been shown to encompass all the processes underlining these two attributes. Hill (1988) defined growth as the sum of those coordinated biological and chemical processes which start with fertilization of the ovum and finished when the body size and physiological functions of the adult animal have been attained. Growth consists basically not only of cell multiplication (hyperplasia) and cell enlargement (hypertrophy) but also involves storage of nutrients in excess of those required for maintenance. True growth is irreversible as opposed to storage, which may represent a temporary phase after which stored nutrients may be utilized by the animal in times of need. Growth is thus not only an increase in body weight, but it is accompanied by a change in form and proportion. Growth involves an increase in the number of cells in the body and an increase in the size of the individual cells. An understanding of carcass proportions and conformity in respect of genotype and sex would be valuable in any attempt at modifying types of meat produced. Information on both physical and chemical characteristics of carcass of several European breeds of pig and indigenous pigs of Nigeria are available in the literature (Sofoluke and Dettmers, 1973; Fetuga

et al., 1976; Madubuike, 1984; Sikka, 2006 and Sikka, 2007). This work is designed to determine the effect of genotype and sex on body weight and carcass traits of pigs.

MATERIALS AND METHODS

Sixty (60) piglets farrowed by two boars (Large White boar and indigenous dihybrid Large Black boar), two indigenous dihybrid Duroc sows, two indigenous dihybrid Large Black sows and four Large White sows kept at Teaching and Research Farm, Federal University of Agriculture were used for this study. The husbandry was intensive system, whereby the animals were kept permanently in the pen and daily management practices were carried out. The mating design is as follows:

♀		♂
LBNH	x	LW = LWLBNH
DNH	x	LW = LWDNH
LW	x	LBNH = LWLBNH

LW = Large White; D = Duroc; NH = NigerHyb;
LB = Large Black

Data collection

Weekly body weights of the progenies were recorded till weaning age of eight weeks. A male and female pig within 5 to 6 months of age were selected from the offspring of each sow and were starved overnight, but water was supplied and slaughtered by stunning and bleeding through the jugular. The carcass characteristics measured include the following; Live weight: weight of the animal before fasting;

Dressing %: This was calculated as the hot carcass weight divided by the live weight

$$\frac{\text{Hot carcass weight} \times 100}{\text{Live weight}}$$

Intestine weight (small and large); Weight of forelegs; Weight of hind legs; Liver weight; Lung weight; Kidney weight; Stomach weight; Head weight; Empty stomach weight; Empty intestine weight (small and large); Loin eye area; Small intestine weight; Large intestine weight; Empty small intestine weight; Empty large intestine weight; Testis; and Uterus.

Statistical Analyses

Data collected on weekly body weight and carcass traits were subjected to General Linear Model (GLM) procedure to compare means. New Duncan Multiple Range Test was used to separate the means that differed significantly (Gomez and Gomez, 1984).

The statistical model used is as follows:

$$Y_{ijk} = \mu + B_j + S_k + (BS)_{jk} + \epsilon_{ijk}$$

Where: Y_{ijk} = observations on the parameters, μ = Universal means, B_j = effect of genotype (1-2), S_k = effect of sex (1,2), $(BS)_{jk}$ = interaction between genotype and sex, ϵ_{ijk} = experimental error

RESULTS

Effects of sex and genotype on the weekly body weight are showed in Table 1. Sex effect on the weekly body weight of the pigs was significant ($p < 0.05$) at weeks 6 – 8, but not significant at ($p > 0.05$) at weeks 1 - 5. At week 6, the body weight of the male was 4.58 ± 0.17 kg against 4.08 ± 0.14 kg of female. Body weight of males were 5.05 ± 0.22 kg and 5.46 ± 0.24 kg at 7th and 8th week while females were 4.32 ± 0.20 kg and 4.68 ± 0.20 kg, respectively. The percent mortality was 24.2 % and 22.2 % for males and females respectively. Genotype had significant ($p < 0.05$) difference in the body weight of the pigs at week 1. But significant effect was not observed in the other weeks. At week 1, the body weight of the indigenous Large Black-tri-hybrid [(NHLB) LW] was 1.68 ± 0.04 kg, higher than 1.51 ± 0.07 kg of the indigenous Duroc-tri-hybrid [(NHD) LW].

Effects of genotype and sex on Carcass characteristics of the pigs

Table 2 reveals the effects of genotype and sex on carcass characteristics of the pigs. Genotype effects were significant on loin eye area and uterus weight. The loin eye area for LW (NHD)

was 28.40 ± 0.76 cm² which was higher than 24.62 ± 0.39 cm² for LW (NHLB). The uterus weight of LW (NHLB) was significantly ($p < 0.05$) higher than 0.63 ± 0.03 kg recorded for LW (NHD). Genotype effects on other carcass traits considered were not significant ($p > 0.05$). Effects of sex on back fat, kidney weight and stomach weight were significant compared with other carcass traits that had no sex effect. The back fat of the female pig (3.1 ± 0.07 cm) was significantly ($p < 0.05$) higher than 2.70 ± 0.09 cm of male. The kidney weight for male and female pigs were 0.22 ± 0.02 kg and 0.16 ± 0.01 kg respectively. The stomach weight of the female pig was significantly ($p < 0.05$) higher than that of the male pig.

DISCUSSION

Genotype did not have significant effect on pre-weaning weekly body weights of the progenies except at week 1. The non-significant effect observed might be attributed to the closeness of the genotypes. Effect of sex on the weekly body weights of the progenies was significant at weeks 6-8, with males having higher body weights compared to the females. This may be due to the ability of male piglets to compete more favourably for milk and feed compared to the female counterparts. The progressive increase in the pre-weaning weekly body weight in both sex and genotypes agree with the findings of Okon *et al.* (2008). Also, Eusebio (1988) reported that growth during the pre-weaning stage was rapid as body cells were multiplying fast. The pre-weaning mortality in males and females observed in this study revealed that more males died compared to females. This agrees with the findings of several authors (Becker, 1995; Svendsen *et al.*, 1986 and Knol *et al.*, 2002). Becker (1995) reported that the increased mortality in males was due to more males being crushed. Genotype effects on carcass traits among the pigs were not significant in almost all the traits except on loin eye area and uterus. The higher value (28.4 ± 0.76) of loin eye area in genotype LW (NHD) was similar to the values reported by Madubuike (1984) and Sikka (2006). The positive correlation between live weight and loin eye area could be responsible for the significant difference. The carcass values observed in this study among the pigs can be compared with the work of Sikka (2006) who reported on the effect of replacing maize and rice bran with paddy on growth performance

and carcass traits of growing finishing pigs. Effect of sex on the carcass traits of the pigs was observed on kidney weight, stomach weight and backfat. The significant higher stomach weight (2.03 kg) observed in females than males could be that digestibility was slower in females compared to males. Females had higher backfat than males while the kidney weight of males (0.22 kg) was higher than that of females (0.16 kg). The reason for this significant difference in backfat may be attributed to more activity found in males which led to burning of more fat in males.

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Table 1: Effect of genotype and sex on weekly body weight (kg) of pigs

Week	LWNHLB	N	LWNHD	N	Male	N	Female	N	Overall	N
1	1.68 ± 0.04 ^a	41	1.51 ± 0.07 ^b	15	1.67 ± 0.06	29	1.61 ± 0.05	27	1.64 ± 0.04	56
2	2.30 ± 0.07	40	2.31 ± 0.13	13	2.36 ± 0.10	28	2.24 ± 0.06	26	2.30 ± 0.06	54
3	2.91 ± 0.13	40	2.88 ± 0.16	13	3.03 ± 0.18	28	2.75 ± 0.09	25	2.89 ± 0.11	53
4	3.31 ± 0.13	37	3.38 ± 0.16	13	3.49 ± 0.17	27	3.13 ± 0.10	23	3.33 ± 0.10	50
5	3.75 ± 0.13	37	3.89 ± 0.13	13	3.96 ± 0.16	27	3.59 ± 0.12	23	3.79 ± 0.10	50
6	4.30 ± 0.15	33	4.53 ± 0.16	13	4.58 ± 0.17 ^a	25	4.08 ± 0.14 ^b	21	4.36 ± 0.12	46
7	4.67 ± 0.21	33	4.88 ± 0.17	13	5.05 ± 0.22 ^a	25	4.32 ± 0.20 ^b	21	4.72 ± 0.16	46
8	5.10 ± 0.23	33	5.14 ± 0.18	13	5.46 ± 0.24 ^a	25	4.68 ± 0.20 ^b	21	5.11 ± 0.17	46
PWM%	25		18.75		24.2		22.2		23.3	

a,b.: means in the same row with different superscripts are significantly different (p<0.05), N- Number of piglets, LWNHLB – Indigenous Large Black Trihybrid, LWNHD – Indigenous Duroc Trihybrid

Table 2: Effects of genotype and sex on carcass characteristic of pigs

	Genotype		Sex		Overall n=16
	LW(NHLB) n=12	LW (NHD) n=4	Male n=8	Female n=8	
Live wt (kg)	56.13 $\pm$ 0.88 ^a	59.00 $\pm$ 0.58 ^a	56.4 $\pm$ 0.78 ^a	57.25 $\pm$ 1.29 ^a	56.84 $\pm$ 0.74
Carcass wt (kg)	39.83 $\pm$ 0.86 ^a	42.9 $\pm$ 0.63 ^a	40.5 $\pm$ 0.87 ^a	40.7 $\pm$ 1.26 ^a	40.6 $\pm$ 0.74
Dress %	70.89 $\pm$ 0.52 ^a	72.88 $\pm$ 0.54 ^a	71.68 $\pm$ 0.64 ^a	71.09 $\pm$ 0.69 ^a	71.39 $\pm$ 0.46
back fat (cm)	2.85 $\pm$ 0.09 ^b	3.05 $\pm$ 0.06 ^b	2.7 $\pm$ 0.09 ^b	3.1 $\pm$ 0.07 ^a	2.9 $\pm$ 0.08
Head wt(kg)	5.43 $\pm$ 0.18 ^a	5.48 $\pm$ 0.08 ^a	5.6 $\pm$ 0.19 ^a	5.28 $\pm$ 0.19 ^a	5.44 $\pm$ 0.14
Leg wt(kg)	1.68 $\pm$ 0.04 ^a	1.51 $\pm$ 0.11 ^a	1.66 $\pm$ 0.04 ^a	1.62 $\pm$ 0.08 ^a	1.64 $\pm$ 0.04
Liver wt (kg)	1.11 $\pm$ 0.04 ^a (1.9)	1.10 $\pm$ 0.09 ^a (1.86)	1.08 $\pm$ 0.04 ^a (1.91)	1.13 $\pm$ 0.07 ^a (1.97)	1.11 $\pm$ 0.04 (1.95)
Lung wt kg	0.53 $\pm$ 0.027 ^a	0.55 $\pm$ 0.30 ^a	0.53 $\pm$ 0.03 ^a	0.54 $\pm$ 0.03 ^a	0.53 $\pm$ 0.02
Kidney wt kg	0.19 $\pm$ 0.02 ^a (0.34)	0.16 $\pm$ 0.01 ^a (0.27)	0.22 $\pm$ 0.02 ^a (0.39)	0.16 $\pm$ 0.01 ^b (0.28)	0.19 $\pm$ 0.012 (0.33)
Spleen wt kg	0.12 $\pm$ 0.01 ^a (0.21)	0.13 $\pm$ 0.01 ^a (0.22)	0.12 $\pm$ 0.01 ^a (0.21)	0.12 $\pm$ 0.01 ^a (0.21)	0.12 $\pm$ 0.011 (0.21)
Heart wt kg	0.26 $\pm$ 0.02 ^a (0.46)	0.23 $\pm$ 0.01 ^a (0.38)	0.28 $\pm$ 0.03 ^a (0.49)	0.23 $\pm$ 0.01 ^a (0.40)	0.25 $\pm$ 0.02 (0.44)
Stomach wt kg	1.60 $\pm$ 0.19 ^a (2.85)	1.68 $\pm$ 0.34 ^a (2.85)	1.21 $\pm$ 0.24 ^b (2.15)	2.03 $\pm$ 0.11 ^a (3.54)	1.62 $\pm$ 0.16 (2.85)
Ept St wt. kg	0.57 $\pm$ 0.01 ^a (1.02)	0.54 $\pm$ 0.02 ^a (0.92)	0.54 $\pm$ 0.02 ^a (0.96)	0.58 $\pm$ 0.01 ^a (1.01)	0.56 $\pm$ 0.01 (0.98)
SI wt. kg	1.79 $\pm$ 0.09 ^a (3.18)	1.53 $\pm$ 0.18 ^a (2.59)	1.67 $\pm$ 0.16 ^a (2.96)	1.79 $\pm$ 0.08 ^a (3.13)	1.73 $\pm$ 0.09 (3.04)
LI wt kg	2.20 $\pm$ 0.11 ^a (3.92)	2.63 $\pm$ 0.11 ^a (4.45)	2.35 $\pm$ 0.18 ^a (4.17)	2.26 $\pm$ 0.09 ^a (3.95)	2.31 $\pm$ 0.09 (4.06)
Intestine wt kg	3.98 $\pm$ 0.18 ^a (7.09)	4.13 $\pm$ 0.14 ^a (7.0)	4.01 $\pm$ 0.25 ^a (7.11)	4.03 $\pm$ 0.14 ^a (7.04)	4.02 $\pm$ 0.14 (7.07)
EptSiwt kg	0.88 $\pm$ 0.04 ^a (1.57)	1.00 $\pm$ 0 ^a (1.69)	0.89 $\pm$ 0.04 ^a (1.57)	0.93 $\pm$ 0.06 ^a (1.62)	0.91 $\pm$ 0.03 (1.60)
Ept LI wt kg.	0.99 $\pm$ 0.06 ^a (1.76)	1.01 $\pm$ 0.07 ^a (1.72)	0.91 $\pm$ 0.07 ^a (1.61)	1.09 $\pm$ 0.05 ^a (1.9)	1.00 $\pm$ 0.05 (1.76)
Loin eye area cm ²	24.62 $\pm$ 0.39 ^b	28.4 $\pm$ 0.76 ^a	25.51 $\pm$ 0.74 ^a	25.61 $\pm$ 0.83 ^a	25.56 $\pm$ 0.54
Foreleg wt kg	0.61 $\pm$ 0.02 ^a	0.64 $\pm$ 0.06 ^a	0.62 $\pm$ 0.01 ^a	0.62 $\pm$ 0.04 ^a	0.62 $\pm$ 0.02
Hind leg wt kg	1.69 $\pm$ 0.65 ^a	0.88 $\pm$ 0.05 ^a	1.03 $\pm$ 0.04 ^a	1.94 $\pm$ 0.98 ^a	1.48 $\pm$ 0.49
Foreleg wt kg	0.61 $\pm$ 0.02 ^a	0.64 $\pm$ 0.06 ^a	0.62 $\pm$ 0.01 ^a	0.62 $\pm$ 0.04 ^a	0.62 $\pm$ 0.02
Hind leg wt kg	1.69 $\pm$ 0.65 ^a	0.88 $\pm$ 0.05 ^a	1.03 $\pm$ 0.04 ^a	1.94 $\pm$ 0.98 ^a	1.48 $\pm$ 0.49

	Genotype		Sex		Overall n=16
	LW(NHLB) n=6	LW (NHD) n=2	Male n=8	Female n=8	
Uterus kg	1.11 $\pm$ 0.07 ^a (1.97)	0.63 $\pm$ 0.03 ^b (1.07)	-	0.99 $\pm$ 0.09 (1.73)	0.99 $\pm$ 0.09 (1.74)
Testis wt kg	0.55 $\pm$ 0.02 ^a (0.97)	0.53 $\pm$ 0.03 ^a (0.89)	0.54 $\pm$ 0.02 (0.96)	-	0.54 $\pm$ 0.02 (0.95)

a,b,: means in the same row with different superscripts are significantly different ($p < 0.05$); ns- not significant, Ept, SI – Empty small intestine SI – Small intestine LI – Large intestine Ept LI – Empty large intestine, ST – Stomach weight Ept ST – Empty stomach weight