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Comparative Study of the Growth and Carcass Characteristics of the Nigerian Indigenous and Large White Pigs

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Abstract: The growth and carcass characteristics of Large White (LW), Nigerian Indigenous (NI) and their F_1 crossbred (LW×NI) pigs were compared across various ages. A total of 51 pigs were used in the study, which comprised 22 NI (12 boars and 10 gilts), 20 LW (10 boars and 10 gilts) and 9 LW×NI crossbred pigs (3 boars and 6 gilts). The three breeds were managed in a similar fashion and slaughtered at 34 weeks of age. There were significant differences ($p<0.01$) in live weight, Average Daily Gain (ADG), Average Daily Feed Intake (ADFI) and Feed Conversion Ratio (FCR) among the NI, LW and LW×NI (F_1) crossbred pigs. At 10 weeks of age, LW boars had significantly higher ADG (125.7 g day^{-1} versus 78.3 g day^{-1}) and consumed more feed (326.2 g day^{-1} versus 146.8 g day^{-1}) than the NI boars. Differences in FCR between the NI and LW boars were significant at 25 weeks of age ($p<0.05$). At similar live weights, LW pigs were significantly ($p<0.01$) younger and had higher in ADG, ADF1 and FCR values than the other breeds. The carcass of NI male pigs yielded significantly ($p<0.05$) higher percent lean (53.3% versus 40.0%), higher four lean cuts (57.7% versus 55.0%), higher percent shoulder (20.1% versus 17.6%) but lower dressing percentage (64.6% versus 69.2%) than in the LW male pigs. It is therefore concluded that whereas the NI pigs grew poorly when compared to the LW counterparts, they possess some superior carcass characteristics.

Key words: Indigenous pig, large white pig, carcass characteristics, Nigerian

INTRODUCTION

Significant improvements in the level of education and per capita incomes are expected in the developing countries and this is expected to result in increased demand for meat and meat products (FAO, 2000). Consequently, several strategies for enhanced meat production have been adopted at both local and international levels. Some of these measures involved large scale transfer of modern scientific practices from developed countries into the developing world. Unfortunately, most of these introductions have been met with failures due to a lack of basic technical expertise and varying degrees of difficulties in adapting them to local conditions. In livestock production, more attention is being given to farming of indigenous species for meat production. Indigenous species are known to perform relatively well under harsh tropical conditions often characterized by feed scarcity and disease challenge. Owing to the critical role played by pork and pork products nutritionally worldwide, several importations of exotic breeds of pigs have been made into Nigeria for either production or to improve the quality of the indigenous stock. Agbagha *et al*. (2001) observed that cross breeding for improvement of local breeds have not yielded any significant positive economic results. Most of these exotic breeds have either performed below expectation or failed to adapt and produce under local conditions. The most significant success in this respect was recorded among the Large White breeds

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of pigs (Payne, 1990). Umesiobi (2000) described the Nigerian Indigenous pigs as poor producing non-descript animals, which are not fit to be integrated into modern living and livestock husbandry. However, no documented evidence was presented in support.

The few and available studies on the productivity and carcass characteristics of the NI pig show generally that they have inferior growth and carcass characteristics when compared to the exotic breeds. Fetuga *et al.* (1977) reported that the Landrace×Large White cross bred (LR×LW) boars were superior to the NI pigs in live weight and number of days required to reach predetermined slaughter weights. Reported values for ADG vary among authors. Fetuga *et al.* (1977) reported 0.32 kg day^{-1} for the LR×LW cross breed, Sonaiya (1986) reported a value of 0.14 kg day^{-1} for the NI pig, whilst Adebambo and Onakade (1983) reported 0.30 kg day^{-1} for the NI×Hampshire crossbreed. Fetuga *et al.* (1976a) observed that the LW×NI crossbred pigs were leaner, contained more bone and less skin than the local pigs across all slaughter weights. Fetuga *et al.* (1976b) observed that the dressing percentage was significantly higher in NI pigs compared to LW×LR pigs and attributed this to increased fat content of carcasses from the indigenous pigs. Cameron and Ashton (1969) had earlier reported the values of 85.1%, 3.7 cm and 21.9 cm^2 for the dressing percentage mean back fat depth and loin-eye muscle area, respectively, among the local black pigs of Ghana. Adebambo (1983) reported that the F_2 progenies having 50% LW, 25% NI and 25% Hampshire (HA) blood had 7 to 10% less muscle depth and 11 to 15% less rib-eye muscle area than the pure LW progenies.

Compared with the exotic breeds, the indigenous breed has received very little research attention and is even in danger of extinction. Moreover, detailed and comprehensive reports comparing the carcass attributes of the NI breed with the widely adapted LW are scarce and probably non-existent. This study was therefore designed to compare the growth performance and carcass characteristics of the Nigerian Indigenous breed with the Large White and their F1 crossbreeds, across various live weights and ages.

MATERIALS AND METHODS

Experimental Animals

A total of 51 piglets comprising 22 NI (12 males and 10 females), 20 Large White (10 males and 10 females) and 9 crosses (3 males and 6 females) were used in the experiment. All piglets were weaned at 5 weeks of age and each breed pooled into a large pen.

Feeding and Management of Experimental Animals

All the experimental animals were fed a corn-groundnut cake based ration formulated as shown in Table 1 and 2. Four feeding regimes were adopted namely: Pre-starter (5-10 weeks of age): Starter (11-15 weeks); Growing (16-25 weeks) and Finishing (26-34 weeks). No creep feeding was provided but piglets were allowed unlimited access to the dam's ration which was formulated to provide 14.78% CP and 10.91 MJ kg^{-1} ME during the pre-weaning days. Pigs were fed in groups once a day, with a quantity of feed estimated at 6% of the total body weight at the end of the preceding week. Leftovers were collected daily and weighed and water was provided *ad libitum*. The animals were initially housed 5 to 6 piglets per pen and gradually reduced to 3 as body weight increased. All the animals were managed in a similar fashion and the minimal space allowance was estimated according to the Recommendation of the Canadian Council Guidelines for the Care and Use of Experimental Animals, CCAC (1993).

Animal Slaughter and Determination of Carcass Characteristics

At the age of 34 weeks, 5 animals were randomly selected from each of the NI males, LW males and LW females and starved for 24 h, while water was provided *ad libitum*. The animals were weighed

Table 1: Ingredient composition of experimental diets

Ingredients (%)	Breeders	Pre-starter	Starter	Growers	Finisher
Maize	30.00	24.00	26.00	28.00	20.00
Maize grits	15.00	12.00	13.00	14.00	32.00
Palm kernel cake	25.00	20.00	22.00	24.00	25.00
Wheat offal	13.00	10.00	11.00	12.50	10.00
Brewers dried grain	13.00	10.00	11.00	12.50	10.00
Bone meal	3.00	3.00	3.00	3.00	2.00
Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.40	0.40	0.40	0.40	0.40
*Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Groundnut cake	0.00	25.00	15.00	05.00	0.00
Total	100.00	100.00	100.00	100.00	100.00

*Vitan: a multivitamin and mineral premix. One kilogram contains Vitamin A, 8,000,000 IU; vitamin D, 1600000 IU; vitamin E, 5000 IU; vitamin K, 2000 IU; vitamin B1, 1500 mg; vitamin B2, 4000 mg; vitamin B6, 1500 mg; vitamin B12, 10 mg; niacin, 15000 mg; pantothenic acid, 5000 mg; folic acid, 5000 mg; biotin, 20 mg; choline chloride, 125 g; antioxidant, 125 g; manganese, 50 g; zinc, 50 g; copper, 5 g; iodine, 1.2 g; selenium, 200 mg; cobalt, 200 mg

Table 2: Calculated nutrient composition of the experimental diets

Nutrients (%)	Breeders	Pre-starter	Starter	Growers	Finisher
Dry matter	89.23	89.78	89.58	89.36	91.20
ME (MJ kg^{-1})	10.91	11.72	11.44	11.11	11.25
Crude protein	14.78	20.42	18.49	16.13	13.78
Crude fat	3.65	4.23	4.03	3.79	4.06
Linoleic acid	1.67	1.68	1.68	1.67	1.82
NDF	18.96	18.09	18.39	18.75	20.12
ADF	6.60	7.10	6.93	6.72	6.64
Calcium	1.07	0.89	0.96	1.03	0.77
Available phosphorus	0.91	0.73	0.79	0.87	0.56
Lysine	0.91	1.03	0.98	0.93	0.89
Methionine	0.47	0.48	0.48	0.47	0.26

NDF = Neutral Detergent Fiber; ADF = Acid Detergent Fiber

and stunned manually using the hammer method, shackled and bled in a vertical position by severing the jugular veins. They were allowed to bleed completely for 15 min. After bleeding the deadweight was measured. The difference between the live and deadweight was calculated and recorded as the weight of blood. The carcasses were dressed and cut into the different joints as described in the FAO Guidelines for the Slaughter, Meat Cutting and Further Processing (FAO, 1991). Each joint was weighed and recorded. Thee rib-eye area and back fat thickness were determined by tracing with acetate paper, according to the method described by Burson (2001). The back fat measurements were taken only at the 10th rib whereas rib-eye area was taken at 10th and last ribs of the right side.

Data Collection and Statistical Analysis

Data was collected every week on live weight gain and feed consumption from 5 to 25 weeks of age. These were used to compute the Average Daily Gain (ADG), Average Daily Feed Intake (ADFI) and Feed Conversion Ratio (FCR) (ADG/ADFI). Data on growth performance was analyzed at 5, 10, 15 and 25 weeks of age using the Completely Randomized Block Design (CRBD). Breed and sex served as treatments while age served as blocks. In order to remove variation introduced by differences in live weight on growth performance parameters, the mean ADG, ADFI and FCR and average daily feed intake per unit live weight at similar live weights of approximately 3, 4.5 and 6.5 kg, were determined for each sex in the three breeds. These were also analyzed using CRBD with the fixed live weights serving as blocks. Since all animals were slaughtered at the same age (34 weeks), carcass characteristics were analyzed using the Completely Randomized Design (CRD). Analysis of variances was carried out on all the parameters and means separated by the Least Significant Difference (LSD) as described by Little and Hills (1978).

RESULTS

Growth and Feed Intake

The comparisons of the live weight, growth performance, feed intake and feed conversion ratio between the NI, LW and their FI crosses at 5, 10, 15 and 25 weeks of age are shown in Table 3. The average live weight of the pigs showed much variation across and within the breeds. The live weights were not significantly different ($p>0.05$) until the age range of 15 to 25 weeks. At the 15th week of age, LW males and females were significantly heavier than NI males and F1 males ($p<0.01$) whereas the live weights of LW males and females, NI females and F1 females were similar ($p>0.05$). At the 25th week of age, NI males and females and the F1 males were similar in live weight ($p>0.05$), but significantly ($p<0.05$) lower than the F1 females. LW males were significantly ($p<0.05$) heavier than the LW females. The Average Daily Feed Intake (ADFI) varied significantly ($p<0.01$) across the different ages and breeds. At 10 weeks of age, the LW pigs consumed significantly ($p<0.05$) more feed than the NI and the F1 crossbred pigs. Females consumed significantly ($p<0.05$) less feed among the LW breed but more among the NI and the F1 crossbred pigs at 25 weeks of age.

The feed conversion ratio (FCR) decreased significantly ($p<0.05$) from the 10th to 25th weeks of age among the NI male pigs but was similar ($p>0.05$) among the LW males. Intra-breed variation due to sex was not significant ($p>0.05$) in all the breeds and ages except among the NI at 25 weeks of age and the LW pigs at 15 weeks age. When the average daily gains at similar weights (3.0, 4.5 and 6.5 kg) were compared (Table 4), irrespective of the age, it was discovered that among the three breeds, live

Table 3: Growth performance of Nigerian indigenous, large white and their F_1 crosses at various ages

		NI		LW		F1 cross		
Parameters	Age (Weeks)	Male	Female	Male	Female	Male	Female	SEM
Live weight	5	3.5^{a}	3.7^{ab}	5.6^{abc}	4.7^{abc}	3.3^{a}	3.5^{a}	1.89
(kg)	10	5.2^{abc}	5.1^{def}	9.0^{def}	7.8^{cde}	5.0^{abc}	5.1^{abc}	
	15	7.1^{cd}	7.8^{cde}	13.1^{gh}	11.8^{fgh}	6.9^{bcd}	7.8^{cde}	
	25	10.4^{efg}	9.13^{def}	26.5^{j}	20.9^{i}	11.9^{fgh}	14.4^{h}	
ADG	5	78.3^{defgh}	84.9^{defghi}	125.7^{kl}	100.0^{hijk}	68.6^{cdef}	74.3^{cdef}	16.68
(g day^{-1})	10	48.6^{bc}	40.0^{b}	97.1^{ghij}	88.6^{efghi}	48.6^{bc}	45.7^{b}	
	15	54.3^{bcd}	77.1^{defgh}	117.1^{ijkl}	114.3^{ijkl}	54.3^{bcd}	77.1^{defgh}	
	25	47.1^{bc}	19.0^{a}	191.4^{m}	130.0^{l}	71.4^{cdef}	94.3^{fghij}	
ADFI	10	146.8^{a}	146.8^{a}	326.2^{bc}	283.6^{b}	159.2^{a}	159.2^{a}	37.39
(g day^{-1})	15	261.8^{a}	289.2^{b}	428.9^{kl}	377.0^{cd}	286.7^{b}	286.7^{b}	
	25	303.9^{b}	374.9^{cd}	636.0^{f}	541.9^{e}	441.1^{d}	546.2^{e}	
FCR	10	3.0^{fg}	3.7^{defg}	3.4^{efg}	3.2^{fg}	3.4^{efg}	3.5^{defg}	0.21
(%)	15	4.8^{cd}	3.8^{cdefg}	3.7^{efg}	3.3^{bc}	5.3^{bc}	3.7^{cdef}	
	25	6.5^{b}	19.6^{a}	3.3^{efg}	4.2^{bcdef}	6.2^{b}	5.8^{b}	

$^{a, b, c, \ldots, m}$ Means within a row or column with a similar superscript are not significantly different ($p>0.05$) ADG = Average Daily Gain; ADFI = Average Daily Feed Intake; FCR = Feed Conversion Ratio; NI = Nigerian Indigenous; LW = Large White; F1 = NI x LW cross bred pigs

Table 4: Average daily gain, average daily feed intake and efficiency of Nigerian Indigenous, Large White and their F1 crosses at 3, 4.5 and 6.5 kg mean live weights

	Mean live weight	NI		LW		F1 cross		
Parameters	(kg)	Male	Female	Male	Female	Male	Female	SEM
Live weight	3.0	2.7	3.0	3.3	2.9	3.0	2.9	
(kg)	4.5	4.4	4.3	4.9	4.1	4.5	4.5	
	6.5	6.5	6.7	7.0	6.6	6.0	6.6	
ADG	3.0	79.4^{bcdefg}	90.5^{defg}	160.0^{h}	106.1^{fg}	57.1^{abcd}	64.3^{abcde}	19.40
(g day^{-1})	4.5	46.4^{ab}	52.4^{abc}	94.0^{efg}	112.9^{g}	31.6^{a}	40.5^{ab}	
	6.5	44.1^{ab}	87.2^{cdefg}	107.2^{fg}	74.3^{abcdef}	38.6^{a}	67.8^{abcde}	
ADFI	6.5	275.5^{bcd}	284.5^{cd}	307.3^{d}	218.4^{a}	258.9^{bc}	258.9^{bc}	16.47
(g day^{-1})								
FCR	6.5	5.9^{b}	4.7^{b}	3.5^{a}	3.5^{a}	6.8^{b}	3.8^{a}	0.23
ADFI/Live weight (%)	6.5	4.2	4.3	4.4	3.3	4.3	3.9	0.36

$^{a, b, c, \ldots, m}$ Means within a row or column with a similar superscript are not significantly different ($p>0.05$)ADG = Average Daily Gain; ADFI = Average Daily Feed Intake; FCR = Feed Conversion Ratio; NI = Nigerian Indigenous; LW = Large White; F1 = NI×LW cross bred pigs

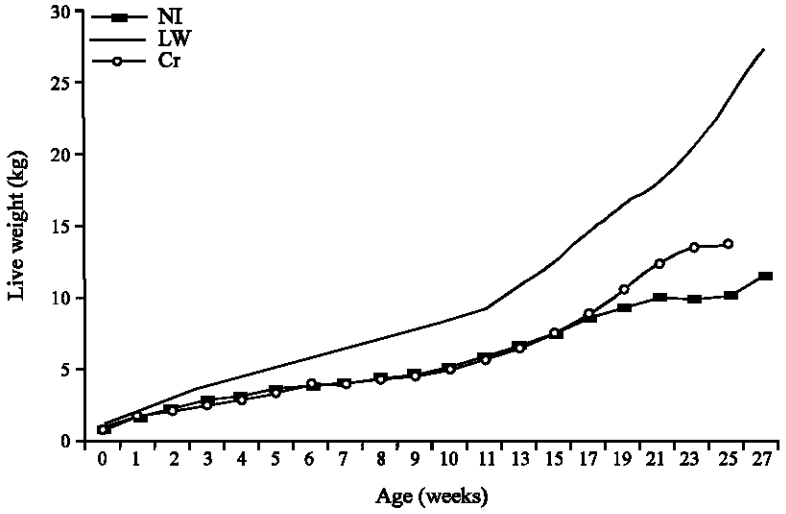

Fig. 1: Plot of live weights of Nigerian Indigenous (NI), Large White (LW) and their F1 cross (F1) pigs against age

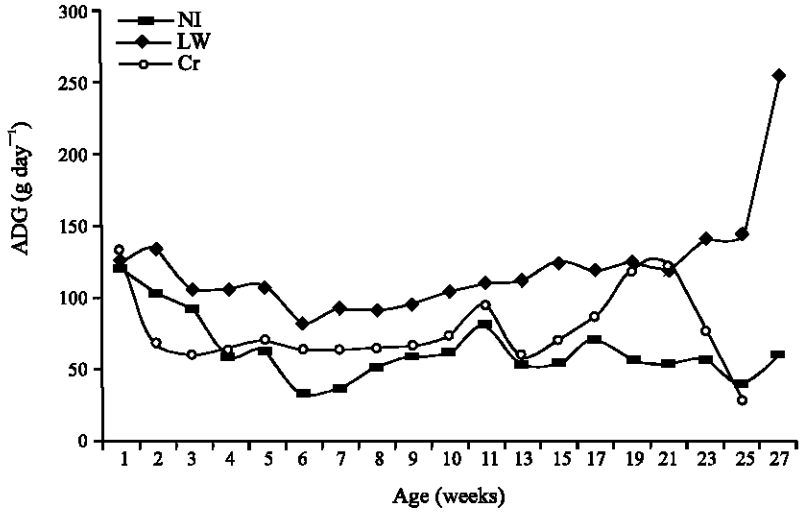

Fig. 2: Plot of the Average Daily Gain (ADG) of the Nigerian Indigenous (NI), Large White (LW) and their F1 crosses against age

weight had no effect on gain ($p>0.05$). Gain varied very significantly ($p<0.01$) across the breeds. LW pigs grew significantly ($p<0.5$) more than NI pigs whilst NI pigs were similar to F1 crosses. Males had lower growth rates among the NI and F1 crosses, but higher values among the LW breeds. At 6.5 kg live weight; LW males consumed more feed than LW females (307.25 g versus 218.44 g). The LW breed was significantly ($p<0.05$) more efficient in gaining weight than the NI and F1 crossbred pigs. Neither breed nor sex had any significant effect on ADFI per unit live weight.

Figure 1 is the growth curve of the three breeds of pigs. The curves show that the growth pattern of the three breeds of pigs are similar and resemble the sigmoid curve. A closer assessment shows that

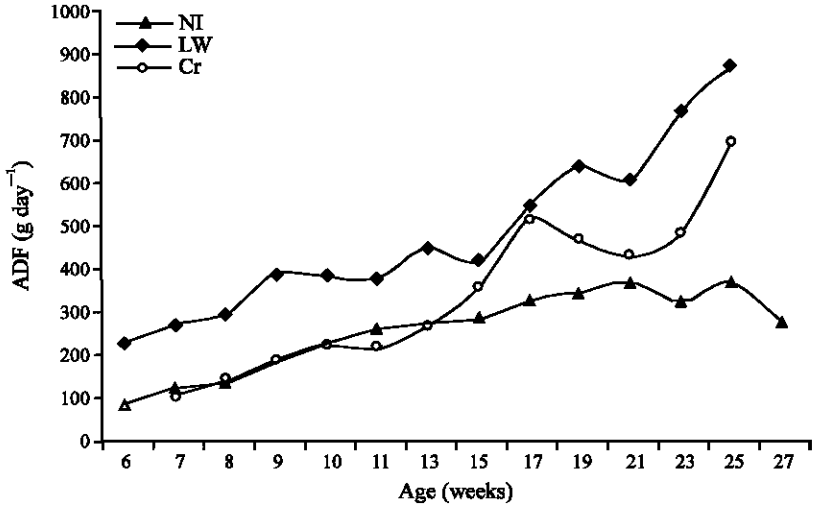

Fig. 3: Plot of the Average Daily Feed Intake (ADFI) of the Nigerian Indigenous (NI), Large White (LW) and their F1 Crosses (F1 Cr) against age

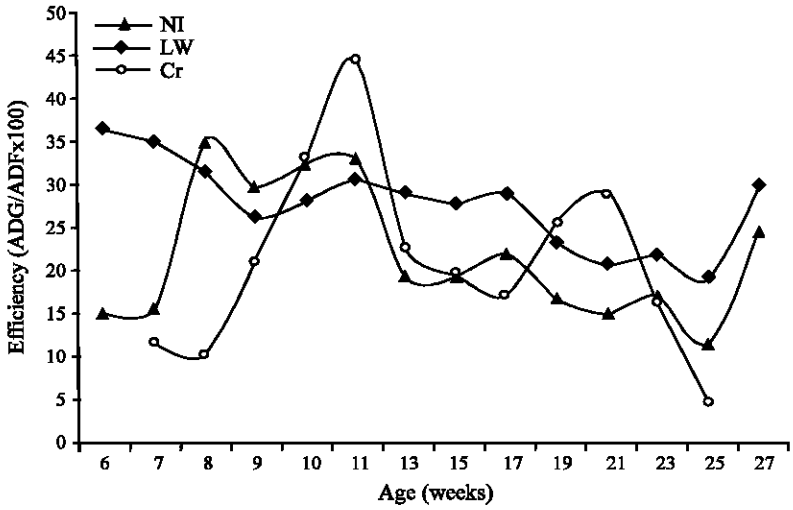

Fig. 4: Plot of the efficiency off feed conversion (ADG/ADFI x100) of the Nigerian Indigenous (NI), Large White (LW) pigs and their F1 crosses against age

the Large White pigs had higher live weights when compared to the locals and the crosses at all ages from three weeks of age. The NI and F1 crosses had similar weights up to the age of 17 weeks such that significant effect of crossing both breeds in the F1 generation was observed from 18 weeks of age. The plot of the ADG against age is shown in Fig. 2. The pattern is similar in all the three breeds. ADG was highest within the first two weeks of life and dropped progressively to the minimal values at 6 weeks in LW and NI pigs. From 7 to 25 weeks of age, the ADG among the LW pigs progressively increased from 80 to 142 g day^{-1} whereas among the NI pigs, the increase was sustained only to the 11th week of age (30 to 80 g day^{-1}) and then dropped to 38 g day^{-1} at 25th week of age. The ADG

of the crossbred pigs decreased from 131 g day^{-1} at 1 week to 66 g day^{-1} at 2 weeks, a level which was fairly maintained until 10th week of age. Subsequently, the ADG fluctuated throughout the remaining experimental period. Figure 3 shows the plot of the Average Daily Feed Intake (ADFI) against age. Feed intake increased regressively from 6 to 34 week of age in all the breeds. The LW consumed more feed than the NI but the curve patterns were similar in all breeds throughout the period of trial, although deflections occurred at certain points. The F1 crosses had similar intakes with the NI until 15 weeks of age. After 15 weeks, intake among the crosses was higher than in the NI. Feed intakes by the crossbreeds were even higher than those of the LW at 17 weeks. The trends in efficiency of gain of the three breeds are shown in Fig. 4. The curve of the LW decreased progressively from 7 to 25 weeks of age. The pattern was similar among the NI and LW breeds, except during the first few weeks of life. Between 9 and 12 weeks of age, the NI pigs had higher efficiencies of gain while the LW had higher values throughout the rest of the experiment. The pattern for the F1 crossbreed was markedly different. It had two notable peaks, at the 11th and 21st weeks of age.

Carcass Characteristics

The carcass characteristics of NI (males) and LW (males and females) are presented in Table 5. The results show that the LW pigs had significantly higher ($p<0.01$) live weights at slaughter than the NI pigs. The LW males had higher live weights than females ($p<0.05$). Although carcass length was similar in LW males and females ($p>0.05$), the males had significantly higher carcass weight than the female counterpart ($p<0.01$). The LW males and females had significantly ($p<0.05$) higher carcass

Table 5: Carcass characteristics of local and large white pigs

	Large white				Local		
	Male		Female		Male		
Parameters	Mean	sd	Mean	sd	Mean	sd	SEM
Live weight (kg)	34.5^{c}	1.23	29.9^{b}	3.21	13.3^{a}	2.35	1.34
Carcass length (cm)	89.0^{b}	0.71	83.7^{b}	3.63	58.5^{a}	3.91	3.07
10th rib-eye area (cm^2)	16.9^{b}	3.15	14.4^{b}	2.51	6.4^{a}	1.27	1.51
Last rib-eye area (cm^2)	21.9	3.70	18.1	3.01	n.d.	n.d.	
10th rib back fat thickness (cm)	1.5^{c}	0.24	1.23^{b}	0.38	0.6^{a}	0.10	0.02
SFFL (kg)	13.9	2.69	11.0	2.20	6.37	0.42	
SFFL/hot carcass weight (%)	57.7^{b}	7.98	54.7^{b}	10.87	84.7^{a}	10.88	7.20
SFFL/Live weight (%)	40.0^{b}	6.85	36.9^{b}	7.50	53.3^{a}	6.46	5.16
Carcass weight (kg)	23.9^{c}	1.43	20.1^{b}	1.24	8.6^{a}	1.91	1.07
% Ham	18.0	0.59	17.4	1.69	18.1	0.61	0.71
% Shoulder	17.6	1.14	16.8	0.58	20.1	1.71	0.78
% Loin	15.1	0.89	15.1	1.61	15.6	1.00	2.65
% Spare ribs	4.4	0.19	4.4	0.58	4.1	0.43	0.46
% Belly	4.8^{b}	0.56	5.8^{b}	0.79	2.7^{a}	0.26	0.37
% Trimmings	9.3^{c}	0.58	7.7^{b}	0.15	3.9	1.33	0.58
Dressing percentage	69.2^{a}	1.84	67.4^{b}	3.08	64.6^{b}	2.56	1.54
% Offal	28.8^{b}	1.78	30.5^{b}	2.21	35.4^{a}	2.56	1.44
Total offal (kg)	10.3	0.97	9.2	1.54	4.7	0.44	
% Head	9.4^{b}	0.42	9.7^{b}	0.61	12.5^{a}	1.29	0.54
% GIT	12.9	1.91	13.6	2.70	10.7	1.04	1.54
% Heart	0.4	0.07	0.4	0.05	0.9	0.48	0.18
% Spleen	0.2	0.00	0.2	0.05	0.4	0.19	0.07
% Liver	1.8	0.13	1.9	0.07	3.0	0.58	0.22
% Testes	0.7	0.09	n.d.	n.d.	1.5	0.39	0.18
% Lungs	1.2	0.13	0.3	0.05	0.9	0.43	0.26
% Kidneys	0.4	0.13	0.3	0.05	0.9	0.43	0.17
% Blood	4.0	0.57	4.0	0.44	4.5	0.71	n.d.
% Four lean cuts	55.0^{ab}	2.03	53.8^{a}	2.62	57.7^{b}	1.19	1.29
% Fat cuts	14.1^{a}	0.59	13.4^{a}	0.80	7.0^{b}	1.55	0.68

$^{a, b \text{ and } c}$ means with different superscripts are significantly different ($p<0.05$) SFFL (NNPC Standardized Fat Free Lean) = 8.588 + (0.465×hot carcass wt., lb)-(21.896×10th rib back fat thickness, in) + (3.005×10th rib eye muscle area, sq. in) n.d. = not determined

weight and carcass length than the NI pigs. There were sex differences in dressing percentage. The NI males and LW females were significantly ($p<0.05$) lower than the LW males in dressing percentage. The mean percentage offal content of NI pigs was significantly ($p<0.01$) higher than the value for LW. The *Longissimus dorsi* cross sectional area (rib-eye area) of the LW pigs was significantly ($p<0.01$) larger than that of the NI pigs. No significant sex differences were found in the rib-eye area of LW pigs. The percentage ham content was similar in all breeds whilst NI male pigs had significantly ($p<0.01$) higher shoulder cut (20.14%) than the LW male pigs (17.2%). The LW male and female pigs had significantly ($p<0.01$) higher percentage belly cut than the NI male pigs. Within the LW breed, there was a significant ($p<0.01$) sex difference for 10th rib back fat thickness, carcass weight and dressing percentage. When the trimmings (trotters, tail, jowl meat) were evaluated, the LW pigs were found to have significantly ($p<0.01$) higher percentage compared to the NI breed (8.45% vs. 3.88%). The NI have a higher proportion of the four lean cuts (shoulder, ham, loin and spare ribs), 57.9% compared to 55.1% in LW males and 53.7% in LW females. The NI pigs had higher percent Standardized Fat Free Lean (SFFL), showing that they deposited more lean. The NI pigs yielded higher proportion of offal except the GIT, though the latter was not significantly different ($p>0.05$). The proportions of the internal organs such as heart, liver, spleen, testes, kidney and lungs were similar in both sexes of LW pigs ($p>0.05$), both of which were significantly ($p<0.05$) lower than the values for the NI male pigs.

DISCUSSION

Our results demonstrate significant breed differences in the rate of live weight gain, average daily feed intake and feed efficiency (Table 3). Fetuga *et al.* (1976a) and Fetuga *et al.* (1977) also reported that there were highly significant breed differences for growth, feed efficiency and carcass characteristic between the NI and imported European breeds. Fetuga *et al.* (1976a) observed that the maximum growth rate occurred in the growth phase between 45.5 to 56.8 kg live weights corresponding to 21 to 26 weeks of age. In this study, maximum growth rate occurred in the pre-weaning stage despite the fact that no creep feed was provided. Genotypic or management differences may account for the discrepancy. It was observed in this study that neither breed nor sex had any significant effect on ADFI per unit live weight (Table 3). This suggests that the differences in ADFI found among genotypes could be determined more by live weight than by genotype. Since at similar weights, efficiency varied among genotypes, it implies that efficiency of gain was much more genetically controlled among the treatment groups. These results indicate that the major problem in rearing NI pigs is their poor feed efficiency and this should guide future improvement strategies. When considered against the fact that the local breed performed better at lower protein levels than exotic breeds (Ilori, 1974; Bressani, 1974; Fetuga *et al*., 1977) it is probable that the lower efficiencies of feed conversion observed in the NI breed and the cross breed could have been due to the effect of the higher protein content of the rations fed in this study. Fetuga *et al.* (1977) had reported that protein levels higher than 16% crude protein reduces feed efficiency in local breeds. Nevertheless, the live weights and average daily gains of all breeds determined in this study were lower than those reported in previous studies (Ilori, 1974; Fetuga *et al*., 1977; Ilori and Adepoju, 1980; Ilori *et al*., 1984). The reasons for the discrepancies were not very clear. Since the NI breed has not been standardized and developed, a lot of genotypic variations may occur across different agro-ecological zones. Although the Large Whites performed below expectation in this study, results were similar to that of Sonaiya (1981) who recorded mean live-weights of 10 kg and 13 kg in local pigs at 4 and 7 months of age and 11 kg and 25 kg for the LW pigs at similar ages. He also observed that over all ages, the females were heavier than the males. Evidence suggests that a lot of inbreeding had taken place within the LW flock in our research farm and the resultant inbreeding depression may have affected the growth rate of LW pigs. The growth pattern (Fig. 1) was expected and the curves resemble the widely

accepted standard sigmoid growth curve of vertebrates (Hammonds, 1940). The superiority of the F1 crossbreed over the N1 breed in live weight gain became apparent from the 18th week of age, an indication of a different response to finishing. It may thus be argued that the genes from the NI pigs dominated growth performance factors (traits), while the accretion factors were principally controlled by genes inherited from the LW.

Generally, carcass lengths reported in this study (Table 5) were similar to those observed by Fetuga *et al*. (1975). The dressing percentages for NI males, LW males and LW females are lower than the figures reported by Fetuga *et al*. (1975), but higher than that recorded by Sonaiya (1986) for the NI pigs. Iloeje (1985) reported significant breed differences in carcass characteristics. The similarity in rib-eye area between the male and female LW pig was expected as many authors such as Sonaiya (1986), Iloeje (1985) and Baas and Mabry (1998) reported a highly positive correlation between rib eye area and carcass weight. The LW also had significantly higher back fat thickness than the NI pigs ($p<0.01$) and this is in agreement with Adebambo (1983) and Sonaiya (1986). The higher shoulder cut among the NI breed (Table 5), implies that there is a more prominent development of the fore quarters compared to the LW, an indication that androgenic activity may be higher in the NI breed. The higher percent head content in NI pigs supports this. The significantly higher four lean cuts recorded by the NI male pig over the LW counterpart implies that the NI pig had higher potential for lean cuts. These results are contrary to those observed by Fetuga *et al*. (1975) who recorded that the NI pigs has lower percent ham, shoulder, loin and the four lean cuts but higher fat cuts. It is likely that the lower dressing percentage found among the NI pigs in this work was due to its higher proportion of the head. The proportion of internal organs was higher in NI pigs than in LW pigs. It is likely that the activity of these organs per unit of the animal's body weight was higher in the NI than in LW breeds. Consequently, the NI breed may be metabolically more a active animals. During the course of this experiment, it was observed that they were behaviorally more active. Hyperactivity is also known to have hormonal underpinnings (Gyton and Hall, 2000). It may be that their reduced rate of live weight gain and feed efficiency were caused by this increased activity and restlessness. It is thus advisable that selection for behavioral characteristics of progenies be incorporated into the breeding programs aimed at improving the growth, carcass and meat quality attributes of NI pigs.

CONCLUSIONS

Within the circumstance of this study, results of growth performance show that the LW breed gained more live weight than the NI pigs and cross breeding failed to improve growth performance in the F1 generation. However, better responses to finishing were observed among the crossbred pigs. Evidence from the literature suggests that a lower feeding regimen may have produced a different result. The NI pigs had superior carcass characteristics when compared to the LW pigs indicating that they possessed very useful traits, which can be exploited in carcass improvement programs.

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