

COMPARATIVE RESPONSES OF LARGE WHITE X LANDRACE  
AND THE INDIGENOUS NIGERIAN PIGS TO DIETS OF  
VARYING PROTEIN CONCENTRATION

By

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SUMMARY

A total of 60 pigs made up of 30 Large White x Landrace pigs (LW x LD) and 30 indigenous Nigerian pigs were allocated to five groups of 12 pigs each, such that there were 3 barrows and 3 gilts of each breed within the group. These were individually fed one of 5 dietary protein levels (12%, 14%, 16%, 18% and 20% CP), from an approximate initial weight of 9 kg to a terminal weight of approximately 68 kg, at which weight all pigs were slaughtered for carcass appraisal.

Protein level increments significantly improved both rate and efficiency of gain of the LW x LD pigs, being best on the 20% protein diet. For the IND pigs, best rate of gain was obtained on the lowest protein level, while at levels of protein above 16%, an obvious decline in rate of gain resulting from further increases in protein levels were observed. Feed efficiency in the IND pigs was improved when protein levels in diets were increased from 12% to either 14% or 16%. This improvement was more obvious at lower weight class intervals, than when pigs were

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reared to heavy weights. Carcass traits were improved in both breeds as protein levels were increased, the improvements being more marked for the LW x LD pigs. There were highly significant breed differences for growth, feed efficiency and all carcass measurements. Significant breed x ration interaction was obtained for growth rate, feed efficiency and most carcass traits, except percentages bone, skin and shoulder, carcass length and dressing percentage. The results indicate obvious differences in protein and amino acid requirements for growth and best carcass quality, which are discussed in relation to inherently different capacities for proteinaceous and fatty tissue growth.

### INTRODUCTION

Two previous reports (Fetuga, Babatunde and Oyenuga, 1976a and Fetuga et al., 1976b), have dealt with the performance and physical carcass traits in the indigenous pigs respectively. The indications were that these pigs performed much better under intensive management conditions, though their carcass characteristics were poor when judged by current British and American Standards. Two earlier reports, Ilori (1974) and Bressani (1974), had also indicated much lower protein requirements of the indigenous pigs relative to the imported European breeds. These studies were essentially concerned with growth rate and efficiency of feed utilisation of these pigs over fairly wide weight class intervals. The report by Fetuga et al. 1976a, had suggested that the indigenous pigs matured earlier and had

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a lower potential for lean tissue growth compared to the imported European pigs. Such earlier maturing breeds would tend to have the rate of fat deposition overtaking lean tissue deposition at an earlier stage than latter maturing breeds. The net effect of this may be that the protein needs may be initially high but decline much earlier than in breeds maturing latter. It is quite possible therefore that over the weight range reported by Ilori (1974) and Bressani (1974), several changes in the nutrient requirements of the indigenous pigs may occur over several short weight class intervals. Such changes are likely to occur much earlier in the indigenous compared to their European counterpart. Moreover, while additional protein may not beneficially influence growth rate of the indigenous pigs, it may result in improved carcass quality. Several reports, (Cooke, Lodge and Lewis, 1972; Ohea and Leveille, 1969 and Fetuga *et al.* 1975a & b) have shown this to be true in the case of European breeds of pigs. It was envisaged that this may well apply in the case of the indigenous pigs of Nigeria.

The purpose of the present study was therefore to assess on a comparative basis, the response of both exotic and indigenous pigs to protein increments in diets of fairly constant digestible energy concentration, over several well defined weight class intervals. It was also intended to assess the effect of protein in excess of those suggested to be adequate for the optimum growth of the indigenous pigs on their carcass characteristics.

## MATERIALS AND METHODS

### Animals.

A total of 60 Large White x Landrace pigs and Indigenous Nigerian pigs weaned at 8 weeks and weighing initially between 8 and 9 kg were assigned to 5 groups of 12 pigs each on the basis of breed, sex, average initial weight and litter origin, such that the average group weights were similar. Within groups care was taken to ensure closely similar mean initial weights between breeds. There were in each group 6 Large White x Landrace pigs (LW x LD) and 6 Indigenous Nigerian pigs (IND). The indigenous pigs used had been selected for growth rate over a three year period.

### Housing and Management.

All pigs were housed in concrete floored pens equipped with individual feeding units. They were assigned individual numbers which tallied with the numbers assigned to the individual feeding units, feed buckets and troughs. The pigs were fed thrice daily all the feed they would consume in  $1\frac{1}{2}$  hours each time, in individual feeding stalls. At the end of each feeding period, pigs were led out into playing and sleeping pens where they had access to water ad-libitum. No bedding materials were provided in the sleeping pens.

Deworming was done a week before the pigs were placed on the test diets and about 6 weeks after the commencement of the experiment with an ascaricidal drug (cupane).

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Individual weight changes for the pigs were recorded weekly, while weekly feed consumption was calculated from the differences between the amounts of feed offered and refused. When pigs attained or exceeded 68 kg at the weekly weighing, water but no further feed was given and the animals were slaughtered about 18 hrs afterwards for carcass evaluation. The carcass treatment, dissection and measurement procedures were as earlier described (Fetuga *et al.*, 1975).

### Dietary Treatments.

The study involved a comparison of five diets formulated to give a single digestible energy value of approximately 3800 kcal/kg and crude protein levels of 12%, 14%, 16%, 18% and 20%. The actual values on analysis differed slightly from the calculated values (Table 1). The dietary ingredient composition as well as the analysed levels of some nutrients appear in table 1. In balancing the diets, an attempt was made to maintain approximately the same ratios of the main protein concentrate, fish meal, blood meal and groundnut cake, thus maintaining at approximately the same proportions, the amino acids contributed from plant and animal sources, even though the absolute quantities varied. The calculated essential amino acid composition of the experimental diets is presented in table 2. Except for lysine tryptophan and methionine + cystine, most diets appeared to contain adequate or more than adequate quantities of other essential amino acids.

Table 1. Composition of Experimental Diets (% of air-dry diets)

Ingredients	Diets (% of protein levels)				
	12	14	16	18	20
Yellow maize	83.80	78.26	74.64	70.20	66.75
Groundnut cake	5.20	8.80	11.20	14.00	16.50
Fish meal	1.10	2.64	3.60	4.20	4.80
Blood meal	1.65	2.20	2.80	3.50	4.00
Rice-bran	2.50	2.50	2.50	2.50	2.50
Vit-Min-Premix +	0.50	0.50	0.50	0.50	0.50
Oyster shell	0.75	0.75	0.75	0.75	0.75
Bone meal	1.50	1.50	1.50	1.50	1.50
Palm oil	2.50	2.50	2.50	2.50	2.50
Salt (NaCl)	0.50	0.50	0.50	0.50	0.50
Zinc ++	+	+	+	+	+
Total	100	100	100	100	100
Analysed crude protein (% DM)	12.46	14.19	16.29	18.38	21.06
Analysed calcium (% DM)	0.86	0.94	0.96	0.99	1.02
Analysed Phosphorous (% DM)	0.59	0.68	0.72	0.71	0.74
Analysed gross energy (Kcal/100 g feed)	465.0	458.0	461.0	459.0	464.0
Calculated digestible energy (Kcals/100g feed)	385.1	386.2	379.4	381.5	388.6

+ A Pfizer Livestock feed product, the composition of which has been described in detail in a previous publication (Fetuga et. al. 1975).

++ Additional Zinc was provided in the diet as Zinc oxide included at the expense of an equivalent weight of maize to provide 100 ppm additional zinc in all diets.

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Table 2. Calculated<sup>+</sup> amino acid composition of experimental diet as Percentages of final diet (on air dry basis)

Essential amino acids	(Diets (% protein levels))				
	12	14	16	18	20
Lysine	0.63	0.70	0.81	0.95	1.07
Methionine	0.14	0.19	0.21	0.24	0.28
Methionine + Cystine	0.30	0.38	0.42	0.46	0.52
Histidine	0.41	0.69	0.73	0.79	0.85
Iso-leucine	0.49	0.62	0.65	0.73	0.79
Leucine	1.55	1.75	1.88	2.03	2.17
Phenylalanine	0.69	0.84	0.96	1.08	1.18
Arginine	0.94	1.14	1.32	1.51	1.72
Threonine	0.52	0.68	0.73	0.81	0.87
Tryptophan	0.12	0.15	0.16	0.18	0.20
Valine	0.73	0.89	1.00	1.12	1.22

+ The essential amino acid values presented were calculated on the basis of the ingredient amino acid composition reported by Fetuga, Babatunde and Oyenuga (1973).

Statistical analysis.

All data were subjected to multiway analysis of variance and where significant differences and interactions were indicated, treatment means were compared using the Duncan's multiple range test (Steel and Torrie, 1960).

RESULTSAverage Daily Gains

Results of average daily gains for indigenous (IND.) and Large White x Landrace (LW x LD) pigs reared on diets of varying protein concentration over different weight class intervals between weaning and 68 kg liveweight are present in table 3. For all of the weight ranges studied, there were significant main treatment (protein level) effects. Except for the weight range of 9 to 22.7 kg, where the performance of the two breeds were not significantly different, the LW x LD pigs grew at a highly significantly ( $P < 0.01$ ) faster rate than the indigenous pigs (IND). There were highly significant breed x ration interaction for all the weight ranges. For the LW x LD pigs, increasing protein levels in the diet resulted in increasing rate of liveweight gains up to the 20% protein level, which was the highest level tested in the present study. For the local pigs, however, there were no significant differences in growth rate due to increases in dietary protein levels. Best rate of gain for these pigs appeared to be on the two lowest protein levels. There was a noticeable, though non-significant tendency for growth rate in the indigenous pigs to decline as the

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Table 3. Growth of Large White x Landrace and Indigenous Nigerian Pigs from 9 to 68 kg as Influenced by Dietary Protein Levels (Kg/day)

Weight class Intervals	Breed	(Diets (% Protein Levels))						Mean	SE <sub>m</sub>
		12	14	16	18	20			
9-22.7 kg	LW x LD	0.21	0.30	0.39	0.44	0.46	0.36	± 0.04	
	IND	0.31	0.29	0.28	0.30	0.26	0.29		
	Mean	0.26a	0.30ab	0.34ab	0.37b	0.36b			
	SE <sub>m</sub>	±0.03	0						
9-34.1 kg	LW x LD	0.24	0.36	0.42	0.45	0.48	0.40x	± 0.02	
	IND	0.33	0.34	0.32	0.31	0.31	0.32y		
	Mean	0.29a	0.35b	0.37b	0.38b	0.40b			
	SE <sub>m</sub>	±0.02							
9-45.5 kg	LW x LD	0.28	0.42	0.46	0.51	0.53	0.45x	± 0.05	
	IND	0.36	0.34	0.31	0.33	0.29	0.33y		
	Mean	0.32a	0.38b	0.39bc	0.42c	0.41c			
	SE <sub>m</sub>	±0.014							
9-56.8 kg	LW x LD	0.28	0.47	0.48	0.55	0.57	0.48x	± 0.03	
	IND	0.35	0.36	0.32	0.32	0.28	0.33y		
	Mean	0.32a	0.42ab	0.40ab	0.44b	0.43b			
	SE <sub>m</sub>	±0.04							
9-68.2 kg	LW x LD	0.30	0.45	0.51	0.56	0.56	0.49x	± 0.04	
	IND	0.38	0.39	0.33	0.32	0.29	0.34y		
	Mean	0.34a	0.42b	0.42b	0.44b	0.43b			
	SE <sub>m</sub>	±0.011							

In this and subsequent tables: SE<sub>m</sub> = Standard error of means. a, b, c, .. Main treatment means followed by different letters are significantly different (P 0.05). x, y .. Breed means followed by different letters are significantly different (P 0.05).

protein levels were increased beyond 14%, the depression being most marked on the 20% protein diets.

#### Feed Intake.

The average daily feed intake for indigenous and LW x LD pigs for different weight ranges are summarised in table 4. Increasing protein levels did not consistently influence feed intake in both the IND. and LW x LD pigs. No significant interaction was obtained for breed x ration. There was no clear cut difference in the feed consumption of both breeds, although the IND. pigs consumed more feed than the LW x LD on the 12% protein diets.

#### Feed Conversion Efficiency.

Table 5 summarises the feed conversion efficiency (FCE) for different weight ranges between 9 and 68 kg liveweight, for both LW x LD and IND. pigs. For all the weight ranges studied, there were highly significant differences due to protein levels. Highly significant breed differences were also obtained in the responses to protein levels. Highly significant Breed x Ration interaction was obtained for all the weight ranges except in the interval from 9 to 22.7 kg. For the LW x LD pigs, increasing protein levels resulted in improvements in the FCE being best at the 20% protein level for the range 9-22.7 kg liveweight. The FCE at the 20% protein level in this weight class was significantly better than for the 18% level which was in turn better than for the 16, 14 and 12% protein diets. Exactly similar trends were

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Table 4. Average daily feed consumption of Large White x Landrace pigs and Indigenous Nigerian Pigs reared from 9 to 68 kg as influenced by dietary protein levels.

Weight class intervals	Breed	Diets (% Protein Levels)					Mean	SE <sub>m</sub>
		12	14	16	18	20		
9-22.7 kg	LW x LD	0.76	0.77	0.96	0.96	0.81	0.83	+ 0.09
	IND.	0.91	0.77	0.81	0.82	0.75	0.81	
	Mean	0.84	0.77	0.89	0.84	0.78		
	SE <sub>m</sub>	+0.12						
9-34.1 kg	LW x LD	0.85	0.93	1.02	0.95	1.00	0.95	+ 0.14
	IND.	1.06	0.99	0.92	0.98	1.00	0.99	
	Mean	0.96	0.96	0.97	0.97	1.00		
	SE <sub>m</sub>	+0.08						
9-45.5 kg	LW x LD	0.99	1.08	1.07	1.16	1.16	1.09	+ 0.16
	IND.	1.24	1.09	1.05	1.15	1.02	1.11	
	Mean	1.12	1.09	1.06	1.16	1.09		
	SE <sub>m</sub>							
9-56.8 kg	LW x LD	1.04	1.24	1.22	1.31	1.32	1.23	+ 0.08
	IND.	1.36	1.41	1.25	1.21	1.08	1.26	
	Mean	1.20	1.33	1.24	1.26	1.20		
	SE <sub>m</sub>	+0.10						
9-68.2 kg	LW x LD	1.14	1.25	1.34	1.39	1.38	1.30	+ 0.11
	IND.	1.48	1.51	1.31	1.28	1.14	1.34	
	Mean	1.31	1.38	1.33	1.34	1.26		
	SE <sub>m</sub>	+0.14						

Table 5. Feed Efficiency of Large White x Landrace and Indigenous Nigerian Pigs Reared from 9 to 68 kg as Influenced by Dietary Protein Levels (Kg feed/Kg gain)

Weight class intervals	Breed	Diets (% Protein Levels)					Mean	SE <sub>m</sub>
		12	14	16	18	20		
9-22.7 kg	LW x LD	3.62	2.58	2.46	1.96	1.75	2.47x	+ 0.021
	IND.	2.94	2.66	2.89	2.74	2.87	2.82y	
	Mean	3.28a	2.62b	2.68b	2.35c	2.31c	-	
	SE <sub>m</sub>	+0.019						
9-34.1 kg	LW x LD	3.56	2.59	2.44	2.11	2.08	2.56x	+ 0.018
	IND.	3.22	2.92	2.86	3.16	3.23	3.07y	
	Mean	3.39a	2.76b	2.65c	2.64c	2.66c	-	
	SE <sub>m</sub>	+0.023						
9-45.5 kg	LW x LD	3.54	2.57	2.32	2.28	2.19	2.58x	+ 0.022
	IND.	3.44	3.21	3.38	3.48	3.52	3.41y	
	Mean	3.49a	2.89b	2.85b	2.88b	2.86b	-	
	SE <sub>m</sub>	+0.017						
9-56.8 kg	LW x LD	3.71	2.64	2.54	2.38	2.32	2.72x	+ 0.024
	IND.	3.88	3.92	3.89	3.79	3.86	3.87y	
	Mean	3.80a	3.82b	3.22b	3.09c	3.09c	-	
	SE <sub>m</sub>	+0.025						
9-68.2 kg	LW x LD	3.79	2.77	2.62	2.48	2.46	2.82x	+ 0.019
	IND.	3.89	3.88	3.96	4.02	3.98	3.95y	
	Mean	3.84a	3.33b	3.29b	3.25b	3.22b	-	
	SE <sub>m</sub>	+0.022						

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noticeable for the 9 to 34 kg and 9 to 45.5 kg liveweight ranges. When the LW x LD pigs were reared to heavier weights (56.8 and 68.2 kg), even though increasing the protein levels improved FCE, significantly, the improvement for pigs on the 20% protein diets over those of pigs on the 18% protein diets were not significant. For the indigenous pigs, increasing the protein level from 12 to 14% resulted in significant improvements in FCE for the weight ranges from 9 kg to 22.7, 34.1 and 45.5 kg. liveweight respectively. No further improvements were obtained beyond this level. When the indigenous pigs were reared up to 56.8 or 68.2 kg liveweight, there were no improvements in feed efficiency as protein levels increased. Instead, there was a tendency towards a worsening efficiency with increasing protein levels.

### Gross Carcass Composition

The gross carcass composition of both the LW x LD and IND. pigs, slaughtered at a predetermined slaughter weight of approximately 68 kg is presented in table 6. Percentage lean meat was significantly increased while percentage fat in dressed carcass decreased as protein levels were increased, the most lean and least fat being obtained on the 20% protein diets. The values were not however significantly higher than the lower values obtained on the 16 and 18% protein diets. There was a highly significant Breed x Ration interaction for percentages lean and fat in dressed

Table 6. Gross Composition<sup>†</sup> of Large White x Landrace and Indigenous Nigerian Pigs reared from 9 to 68 kg liveweight as influenced by dietary protein levels.

Breed	Diets (% Protein Levels)					Mean	SE <sub>m</sub>
	12	14	16	18	20		
Lean (%)	LW x LD	54.63	55.11	57.38	57.94	58.86	56.78x
	IND.	47.16	47.54	48.62	48.83	49.62	48.35y
	Mean	50.90a	51.33ab	53.00abc	53.39bc	54.24c	-
	SE <sub>m</sub>	+0.82					+0.62
Fat (%)	LW x LD	25.62	24.07	23.17	22.24	21.86	23.41x
	IND.	34.82	34.40	32.16	31.94	30.86	32.84y
	Mean	30.22a	29.24ab	27.67abc	27.14bc	26.36c	-
	SE <sub>m</sub>	+0.92					+0.68
Bone (%)	LW x LD	9.86	10.14	10.38	10.57	10.32	10.25x
	IND.	8.46	8.31	8.83	8.64	8.96	8.64y
	Mean	9.16	9.23	9.61	9.61	9.64	-
	SE <sub>m</sub>	+0.17					+0.24
Skin (%)	LW x LD	8.84	8.96	8.42	8.96	8.82	8.80x
	IND.	9.32	9.46	10.07	9.87	9.63	9.67y
	Mean	9.08	9.21	9.25	9.42	9.23	-
	SE <sub>m</sub>	+0.13					+0.16

<sup>†</sup> The values in this table represent the percentage of separable tissues in the dressed right half of the carcasses of slaughtered animals.

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carcass. Percentage bone and skin were not significantly influenced by main treatment (protein levels). However, there were significant breed differences for these parameters. The LW x LD pigs had very highly significantly higher proportion of lean and lower proportion of fat compared to the IND. pigs. They had a higher percentage bone but lower percentage skin compared to the indigenous breeds. Of particular interest is the fact that even for the indigenous pigs increasing protein levels resulted in a steady increase in the carcass lean percentage and decrease in the carcass fat content.

### Carcass Measurements.

Results for some carcass measurements of LW x LD and IND. pigs fed diets of varying protein concentration are summarised in table 7. Carcass length and dressing percentages were not significantly influenced by protein levels although there was a slight tendency for length to increase and dressing percentages to decrease with increases in protein levels. Increasing protein levels significantly increased loin-eye area in both breeds, there being a highly significant breed x ration interaction for this parameter. Mean backfat thickness was also significantly ( $P < 0.05$ ) reduced as protein levels were increased, the reduction being more marked in the LW'x LD than in the IND. pigs. There were highly significant ( $P < 0.01$ ) breed differences for length, mean backfat thickness and loin-eye muscle

Table 7. Carcass measurements of Large White x Landrace and Indigenous Nigerian Pigs reared from 9 to 68 kg liveweight as influenced by dietary protein levels.

Breed	Diets (% Protein Levels)					Mean	SE <sub>m</sub>
	12	14	16	18	20		
Carcass length (CM)	LW x LD	68.80	68.94	68.30	69.24	69.00	68.86x
	IND.	60.50	62.00	61.60	60.84	63.22	61.63y
	Mean	64.65	65.47	64.95	65.04	66.11	-
	SE <sub>m</sub>	+0.84					+1.22
Mean Backfat thickness (CM)	LW x LD	3.44	3.36	3.30	3.18	3.17	3.29x
	IND.	5.27	5.27	5.28	4.60	4.38	4.99y
	Mean	4.36a	4.33a	4.27a	3.89a	3.78b	-
	SE <sub>m</sub>	+0.15					+0.11
Loin-eye muscle area (sq. cm)	LW x LD	16.53	16.88	17.36	19.66	19.94	18.07x
	IND.	9.84	10.88	14.50	15.36	16.92	14.10y
	Mean	13.19a	13.88ab	15.93bc	17.51cd	18.38d	-
	SE <sub>m</sub>	+0.86					+0.58
Dressing (%)	LW x LD	76.40	76.32	74.51	74.99	73.98	75.24x
	IND.	79.80	80.31	81.70	78.94	78.83	79.92y
	Mean	78.10	78.32	78.11	76.97	76.41	-
	SE <sub>m</sub>	+1.14					+0.94

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area, and significant ( $P = 0.05$ ) breed difference for dressing percentage. The LW x LD pigs were longer, had less backfat, more muscling in the loin-eye and a lower dressing percentage compared to the indigenous pigs.

### Carcass cuts as percentages of Carcass weight.

Results of carcass cuts as percentages of dressed carcass weight are presented in table 8. Highly significant ( $P = 0.01$ ), main treatment effects (protein levels) were obtained for percentages ham and fat trim and significant ( $P = 0.05$ ) main treatment effect for percentages loin, four lean cuts and fat cuts. Percentage shoulder cut was not significantly affected by protein levels. Significant breed x ration interaction was obtained for percentages ham, loin, fat trim and four lean cuts, but not for shoulder and fat cuts. Highly significant ( $P = 0.01$ ) breed differences were obtained for all of these parameters. The generally observed trend was that of an increase in proportions of ham, loin, four lean cuts and a decrease in proportion of fat cuts and fat trim as the protein levels were increased. These trends were more marked for the LW x LD pigs than for the IND. pigs.

### DISCUSSION

Overall, the LW x LD pigs were superior to the indigenous pigs when all performance characteristics were considered which is in line with several earlier observations on the comparative performance of the indigenous and imported

Table 8. Carcass cuts as percentages of dressed carcass of Large White x Landrace Pigs reared from 9 to 68 kg liveweight as influenced by dietary protein levels.

Breed	Diets (% Protein Levels)					Mean	SE <sub>m</sub>
	12	14	16	18	20		
Ham (%)	LW x LD	17.22	17.49	21.20	22.80	23.09	20.36x
	IND.	15.84	16.05	16.77	17.64	18.55	16.97y
	Mean	16.53a	16.77a	18.99b	20.22c	20.82c	-
	SE <sub>m</sub>	+0.28					+0.48
Loin (%)	LW x LD	18.34	18.41	19.41	19.24	19.71	19.02x
	IND.	17.04	17.28	17.39	17.73	17.67	17.42y
	Mean	17.69a	17.85ab	18.40ab	18.49ab	18.69b	-
	SE <sub>m</sub>	+0.31					+0.36
Shoulder (%)	LW x LD	17.49	17.68	18.38	18.18	18.00	17.95x
	IND.	15.16	15.36	16.03	15.62	15.89	15.61y
	Mean	16.33	16.52	17.21	16.90	16.95	-
	SE <sub>m</sub>	+0.24					+0.32
Four Lean Cuts	LW x LD	58.12	59.12	60.11	60.22	61.53	59.82x
	IND.	48.76	49.75	50.27	50.90	51.87	50.31y
	Mean	53.44a	54.44ab	55.19abc	55.56bc	56.70c	-
	SE <sub>m</sub>	+0.62					+1.16
Fat Cuts (%)	LW x LD	22.49	21.55	21.48	20.63	21.14	21.46x
	IND.	26.32	25.86	24.69	24.53	23.84	25.05y
	Mean	24.41a	23.71ab	23.09bc	22.58c	22.49c	-
	SE <sub>m</sub>	+0.24					+0.59
Fat Trim (%)	LW x LD	16.83	15.47	14.96	14.64	13.68	15.12x
	IND.	22.44	21.96	20.47	21.43	20.34	21.33y
	Mean	19.64a	18.72a	17.72b	18.04b	16.99c	-
	SE <sub>m</sub>	+0.36					+1.04

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European breeds of pigs (Hill, 1956; Cameron and Gordon, 1969 and Fetuga et al. 1976a). The carcass traits also indicated a superiority of the imported European pigs over the indigenous breed irrespective of the protein levels fed and confirm the earlier report by Fetuga et al. 1976b regarding the relative carcass merits in LW x LD pigs and confirmed some earlier finding of the protein requirements for these pigs in the tropical environment. The general trend is in consonance with some earlier reports for European pigs (Babatunde, Olomu and Oyenuga, 1972; Fetuga et al. 1975a & b and Cooke, et al., 1972). The indigenous pigs responded differently, their growth rate not being significantly influenced by protein levels. In fact at high protein levels in the diet, growth rate tended to be depressed. This observation is in keeping with reports by Ilori (1974) and Bressani (1974). The tendency for the growth rate of the indigenous pigs to decrease at high protein levels may be related to the positive effects of high protein and amino acid levels on muscle development and its negative effect on fat growth. An earlier report (Fetuga et al., 1976a) had shown muscle development to proceed at a slower rate in the indigenous pig, compared to LW x LD pigs, while the proportion of fat to lean being deposited increased rapidly with increasing liveweight. Because of the lower potential for growth in these pigs, dietary requirements appear to have been met at lower levels than for the exotic pigs. At higher levels of inclusion, large excesses of amino

acids are provided which not only encourage near maximum lean tissue deposition but also depress fatty tissue development. Reports by Cooke et al. 1972 had shown that protein levels in excess of requirements for optimum growth and feed efficiency depressed growth in LW x LD pigs. This they attributed to a reduction in the rate of fat growth with no effect on lean growth. O'hea and Leville (1969), had also suggested that protein per se is involved in the reduction of fatness at high protein levels. They linked this effect to a reduction in the activity of certain key enzymes that are associated with tissue fatty acid synthesis. Assuming that these apply in the case of the indigenous pig, the lowered rate of growth is to be expected since it has been already established (Fetuga et. al. 1976a), that at all stages of growth, the entire components of tissue growth is made up of a greater proportion of fat.

The indigenous pig grew at a faster rate, consumed more feed and utilised feed more efficiently than the LW x LD pigs at the 12% protein diet, beyond this level the LW x LD pigs were superior with respect to rate and efficiency of gain. It was observed that at lower weight classes, there were improvements in the feed conversion efficiency when protein levels were raised from 12 to 14% and 16%. No further improvements were obtained at higher protein levels and the improvements were less obvious when pigs were reared to heavy weights. These improvements may be related to better utilisation of the 14 and 16% protein diets for muscle

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synthesis at these lower weight classes since the indigenous pigs could be classified as an early maturing breed in which predominance of fatty tissue synthesis commences at an earlier stage than in the later maturing breeds (Fetuga et. al. , 1976).

Even though growth rates of the local pigs were not improved by increasing dietary protein levels, in almost all cases, carcass lean content as indicated by the several parameters measured increased, while fat content decreased. This improvement in carcass quality with increasing protein levels was far less marked than observed for the LW x LD pigs, indicating higher protein and amino acid requirements for carcass muscling than required for growth in the local pigs. The protein effect on carcass leanness is related to the effects of excess levels of protein on fat deposition enunciated earlier in this paper.

The results of the present study confirm the lower protein requirements of the indigenous pigs relative to the imported European pigs for growth and for best carcass quality. The differential protein and therefore amino acid levels required is essentially related to breed differences in the capacity for muscle development. All animals have a potential for muscle development which is determined at conception, and a rapid and effective rate of muscle synthesis requires the provision in the diet of the essential constituents for muscle protein synthesis. The higher requirements of the LW x LD pig is therefore essentially related to the greater

rate of lean tissue growth which must be supported by higher quantities of amino acids. Even among European pigs, Bayley and Summers (1968), had reported strain differences in the response of pigs to protein feeding and had attributed this to inherently different potentials for muscle development. Despite improvements in the carcass of the indigenous pig with increases in dietary protein levels, at none of these protein levels were the carcasses comparable to those of the LW x LD pigs. It is therefore doubtful, with the existing demand situation for greater proportion of lean in pig carcasses and the availability of better muscled breeds, whether it is economically desirable to feed high protein diets in an attempt to improve carcass quality considering the fact that the growth rate and feed conversion efficiency at these levels are far inferior to those for the imported European strains and breeds of pigs.

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