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Pigs fed diets that are deficient in any nutrients necessary for growth will generally have a reduced rate of gain and require more feed per unit of gain. Previous research conducted here at the South Dakota Agricultural Experiment Station has indicated that, if a deficient diet is fed in early growth and followed by a diet adequate in nutrients, the pig will grow at a faster rate and "compensate" for the earlier poor performance. This study was conducted to obtain additional information on the effects of a short period of protein insufficiency in early growth on gain and feed efficiency during subsequent growth periods when diets of adequate protein were fed.

Experimental Procedure

Ninety-six pigs averaging about 56 lb. were allotted on the basis of ancestry, weight and sex to 24 lots of four pigs each. Four replicate lots were assigned to each of six treatments. The pigs were housed in an enclosed confinement building in pens with totally slatted floors.

The dietary treatments varied in protein content during the various periods as follows:

Treatment	First 4 Weeks	4 to 8 Weeks	8 Weeks to 220 Lb.
1	12	14	14
2	14	14	14
3	16	14	14
4	12	14	12
5	14	14	12
6	16	14	12

The 16% protein diet fed during the first 4 weeks was considered adequate in protein for pigs of this weight. The 14% protein diet was slightly below recommendations and the 12% protein diet was deficient in protein for pigs of this weight. The 14% protein diet fed during the second 4-week period met recommended requirements for the pigs at that time. In the third period, 12 and 14% protein diets were compared. Composition of the three diets is shown in table 1.

Results

The average daily gains by periods and on an accumulative basis are shown in table 2. During the first 4-week period, there was a highly significant difference in rate of gain among treatments, with gains increasing as dietary

protein increased. Daily gain averaged 1.13, 1.46 and 1.62 lb. for pigs fed diets of 12, 14 and 16% protein, respectively. During the second 4-week period all pigs were fed the same 14% protein diet. However, pigs that had been fed the 12% protein diet previously gained slower than those fed the other treatments. These pigs weighed approximately 87 lb. at the beginning of this period compared to 97 and 101 lb. for those pigs fed 14 and 16% protein diets initially. Thus, they may have had a higher requirement for protein. There were also significant ($P<.05$) differences among treatments for the period from 8 weeks to 220 pounds. In this period, gains were highest for pigs fed 14% protein diets during the initial 4-week period and lowest for those fed 16% protein diets initially. This would indicate compensatory gain occurred during this period. There was no difference in gains between the pigs fed 12 or 14% protein diets during the last period.

Significant differences ($P<.01$) existed among treatments in accumulative gain at all periods. The reduced gain of pigs fed the 12% protein diet during the initial 4-week period was so great that these pigs had a slower accumulative gain throughout the trial. Accumulative gain of pigs fed 14% protein diets initially, on the other hand, was nearly equal to that of pigs fed 16% protein initially by the end of the second 4-week period and slightly greater by market weight. These data would indicate that compensatory gain does occur and may compensate completely for early gain reduction if this reduction is not too severe as appeared to be the case in feeding 12% protein diets.

Table 3 summarizes the results of feed/gain data. During the first 4-week period, the amount of feed required per lb. of gain decreased significantly as the protein content of the diet increased. Pigs fed 12% protein required 3.79 lb. of feed/gain compared to 3.14 and 2.64 lb. for pigs fed 14 and 16% protein diets, respectively. Compensatory performance in feed/gain was noted during the 4- to 8-week period when all pigs were fed 14% protein diets, as pigs initially fed 12 or 14% protein were more efficient than those previously fed 16% protein diets. Also, from 8 weeks to market weight, feed/gain was 3.46, 3.58 and 3.84 for pigs initially fed diets of 12, 14 or 16% protein, respectively. Because of this compensatory effect, there were no significant differences in feed/gain at 8 weeks or market weight.

Carcass data are presented in table 4. There were no significant differences among treatments in carcass length, average backfat, tenth rib backfat, loin eye area or percent lean.

Summary

Ninety-six pigs having an initial weight of approximately 56 lb. were used to study compensatory performance following a 4-week period of dietary protein deficiency. The experiment was divided into three periods, two 4-week periods and a period from 8 weeks to 220 lb. which ranged from 5 to 8 weeks in different groups.

During the first 4-week period pigs gained significantly slower and required more feed/gain as dietary protein was reduced from 16 to 14 to 12%. Compensatory performance in both gain and feed/gain occurred during the final two periods. It would appear that a moderate protein deficiency, such as 14% protein for 4 weeks, does not have a harmful effect on overall performance at market weight.

In fact, gain and feed/gain were equal or slightly superior to that of pigs fed 16% protein diets the first 4 weeks. The more severe protein deficiency of the 12% protein diets initially resulted in an accumulative reduction in daily gain. However, feed/gain was fully compensated by market weight. Carcass characteristics were not different in pigs fed diets varying in protein sequence.

Table 1. Composition of Experimental Diets (Percent)

Ingredient	Protein levels		
	12%	14%	16%
Corn	87.8	82.2	76.5
Soybean meal, 44%	9.3	15.0	20.7
Calcium phosphate	1.3	1.2	1.2
Limestone	.9	.9	.9
Trace mineralized salt	.5	.5	.5
Premix[a]	.2	.2	.2

[a] Supplied per lb. of diet: vitamin A, 1500 IU; vitamin D, 150 IU; vitamin E, 2.5 IU; vitamin K, 1 mg; riboflavin, 1.25 mg; pantothenic acid, 5 mg; niacin, 8 mg; choline, 25 mg; vitamin B_{12}, 5 mcg and aureomycin, 25 milligrams.

Table 2. Average Daily Gains by Periods and Accumulative

	Treatments								
	1,4	2,5	3,6	1	2	3	4	5	6
	Protein, %								
0-4 wk.	12	14	16	12	14	16	12	14	16
5-8 wk.	14	14	14	14	14	14	14	14	14
8 wk.-220 lb.	--	--	--	14	14	14	12	12	12
	Avg Daily Gain by Period, Lb.								
0-4 wk.[a]	1.13	1.46	1.62	1.10	1.46	1.57	1.16	1.47	1.67
5-8 wk.[b]	1.51	1.68	1.61	1.51	1.72	1.58	1.51	1.65	1.65
8 wk.-220 lb.[a]	1.73	1.82	1.61	1.73	1.86	1.56	1.73	1.79	1.67
	Avg Daily Gain, Accumulative, Lb.								
0-4 wk.[a]	1.13	1.46	1.62	1.10	1.46	1.57	1.16	1.47	1.67
0-8 wk.[a]	1.33	1.57	1.62	1.31	1.59	1.57	1.34	1.55	1.67
0-220 lb.[a]	1.50	1.67	1.63	1.51	1.71	1.57	1.49	1.63	1.67

[a] Significant difference (P<.01).
[b] Significant difference (P<.05).

Table 3. Feed/Gain by Periods and Accumulative

	Treatments								
	1,4	2,5	3,6	1	2	3	4	5	6
	Protein, %								
0-4 wk.	12	14	16	12	14	16	12	14	16
5-8 wk.	14	14	14	14	14	14	14	14	14
8 wk.-220 lb.	--	--	--	14	14	14	12	12	12
	Feed/Gain by Periods								
0-4 wk.[a]	3.79	3.14	2.64	3.83	3.25	2.82	3.75	3.03	2.45
5-8 wk.	3.09	3.07	3.38	3.06	3.03	3.24	3.13	3.11	3.52
8 wk.-220 lb.	3.46	3.58	3.84	3.38	3.43	3.85	3.54	3.74	3.84
	Feed/Gain, Accumulative								
0-4 wk.[a]	3.79	3.14	2.64	3.83	3.25	2.82	3.75	3.03	2.45
0-8 wk.	3.36	3.09	3.01	3.34	3.11	3.08	3.38	3.06	2.94
0-220 lb.	3.41	3.32	3.39	3.37	3.25	3.43	3.45	3.38	3.34

[a] Significant difference (P<.01).

Table 4. Effect of Dietary Treatments on Carcass Data

	Protein sequence (%)					
	12-14-14	14-14-14	16-14-14	12-14-12	14-14-12	16-14-12
No. of pigs	7	7	8	8	8	7
Carcass length, in.	30.9	31.9	30.9	30.9	31.1	31.6
Avg backfat, in.	1.13	1.32	1.15	1.18	1.27	1.20
Avg tenth rib fat, in.	.82	1.13	1.04	1.01	1.16	1.06
Loin eye area, sq. in.	4.41	4.29	4.13	4.20	4.30	4.15
Percent lean	54.3	51.1	51.9	52.4	51.1	51.4