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The effect of varying dietary protein and antibiotic levels on the performance of weanling local pigs.

J.O. ILORI AND A. ADEPOJU,
Department of Animal Science,
University of Ife,
Ile-Ife, Nigeria.

Abstract

Two feeding trials were carried out to examine the effect of graded dietary levels of protein and antibiotics on the performance of weanling local pigs. In the first trial, 5 groups of 12 pigs each, were fed a 16% protein diet containing respectively, 5 graded levels of strepcillin (0, 25, 50, 75, 100g/tonne of diet). In the second trial, 9 groups of 8 pigs each, were fed 9 different diets respectively, in a 3 x 3 factorial arrangement of treatments (3 protein levels of 12, 15, 18%, 3 strepcillin levels of 0, 50, 75g/tonne). Daily gains, feed efficiency, scouring incidence, dry matter and crude protein digestibilities were recorded. Increasing dietary strepcillin improved ($P < .05$) growth rate and feed efficiency. The improvement plateaued at 75g strepcillin/tonne diet. A non-significant ($P > .05$) protein x antibiotic interaction effect was observed on pig performance. Feeding antibiotics reduced scouring incidence, but had no significant effect on nutrient digestibilities.

Introduction

The addition of antibiotics to livestock rations has become an integral part of the early weaning technique to combat the stresses involved in the removal of piglets from the dam. Ailments in young pigs such as diarrhoea have been brought under control by the use of antibiotics. Costain and Lloyd (1963) reported that early weaned pigs receiving antibiotics showed a highly significant improvement in live-weight gain, feed efficiency and apparent digestibility of crude protein. Wahlstrom (1956) reported that pigs receiving 50 or 100g/ton of antibiotics required 5% less feed than those on the control diet. Crampton and Harris (1969) in a summary of all antibiotic work to date, reported that antibiotic feeding tended to reduce the amount of protein supplement needed in the ration of pigs. They further stated that the greater beneficial effect of antibiotics was observed during early growth in pigs.

Since information on the beneficial effect of antibiotics on weanling local pigs in Nigeria is meagre, this study was designed:

(a) to study the effect of different levels of strepcillin on performance of weanling local pigs; and

(b) to evaluate the effect of varying levels of protein and antibiotics on the apparent digestibilities of dry matter and crude protein, and the performance of weanling local pigs.

Materials and methods

Experiment 1:

Sixty local pigs weaned at 42 days of age at the University of Ife Farm and averaging 6.38 ± 0.35kg in weight were allotted on the basis of initial weight, litter and sex to five treatment groups to compare the effect of 0, 25, 50, 75 and 100g of strepcillin per tonne of feed on pig performance. In each group of 6 pigs, there were 3 barrows and 3 gilts. There were two replicates for each experimental diet. The basal diet, (a maize-groundnut cake-fish meal fortified with vitamins and minerals), was formulated to contain 16% protein. Strepcillin was added to the basal diet at levels of 0, 25, 50, 75 and 100g/tonne of feed and each level served as a treatment (Table 1).

Records of body weight changes and feed consumption were taken weekly. A daily record for the incidence of scouring for each pig was also kept. The daily score for scouring was based on a scale of to 0-3. where 0 = no scouring and 3 = severe scouring. The maximum weekly incidence of scouring was thus 21.

Experiment II:

Results obtained from experiment 1 showed a plateauing of the response of pigs to strepcillin between 75 and 100g/tonne of feed in a basal 16% protein diet. Consequently, in this experiment, a 3 x 3 factorial arrangement was used to further investigate the effect of the two variables: dietary protein and strepcillin levels on pig performance. A total of 72 local pigs averaging 7.24 ± 0.62kg in weight were randomly allotted on basis of initial weight, litter and sex to nine experimental groups with each group having 4 barrows and 4 gilts. There were 9 experimental diets consisting of fortified maize-groundnut cake meal mixtures. Each was formulated to give three protein levels (12, 15 and 18%), and supplemented with strepcillin to give three antibiotic (0, 50 and 75g per tonne of feed)

levels (Table 1). The 9 experimental groups were fed their respective diets *ad libitum* for a period of 16 weeks. Water was available at all times. Feed intake and growth rate were monitored biweekly.

During the 10th week, a digestion trial was carried out on 2 barrows and 2 gilts per treatment group. These were taken from each treatement and kept in metabolism cages for 2 weeks. Using the total collection method, faeces and feed samples were collected during the last 7 days, while dry matter and nitrogent contents were determined using the AOAC (1970) procedures.

Data from both experiments were analysed by the analysis of variance technique and treatment means compared using Duncan's Multiple Range Test (Steel and Torrie, 1960).

Results

Experiment 1:

The addition of strepcillin to weanling pig diets improved their performance in terms of weight gain and feed efficiency as shown in Table 2 and Fig. 1. Pigs receiving the antibiotic at a level of 75 or 100g/tonne of feed had better ($P < .05$) live weight gains and efficiency of feed utilisation than pigs on the control diet. Pigs receiving 100g strepcillin/tonne of feed, had higher weight gains and better efficiency of feed conversion ($P < .05$) than those receiving 25 or 50g/tonne. There were no significant differences in weight gains and efficiency of feed conversion in pigs receiving 50 or 75 g/tonne and 75 or 100g antibiotic per tonne of feed. Figure 1 shows the response of pigs in terms of average daily gains to various antibiotic levels throughout the experimental period. Results obtained showed that most of the initial response to antibiotic supplementation occurred early in the experimental period after which there was a plateauing of response.

The average scores for the incidence and severity of scouring are presented in Table 3. Throughout the 12 weeks of this study, scouring was not observed to be a major problem in the group of pigs used. However, the results showed a marked reduction in scouring following each incremental addition of strepcillin to weanling pig rations.

Experiment II:

A summary of the performance characteristics of pigs as affected by different protein and antibiotic levels is given in Table 4. Pigs receiving protein levels of 15 and 18% had significant increases in average daily gains (ADG) over those fed the 12% protein diet.

Increasing protein levels from 15 to 18% resulted only in a slight increase (0.01 kg) in ADG. The level of antibiotic fed increased ADG as the level was increased from 50g to 75g/tonne of feed at all protein levels. The response to antibiotics was however, highest at the lowest protein level. Pigs on the 18% protein diet and receiving 50g antibiotic per tonne of feed had higher ADG values ($P < .05$) than pigs receiving the 15 or 18% protein diet, and the 18% protein diet with 50g antibiotic per tonne of feed. There were no appreciable differences in daily feed intake figures for the different protein and antibiotic levels and no trend in consumption pattern could be established.

The dietary protein level affected feed/gain (F/G) ratio. Pigs receiving dietary protein levels of 15 and 18 had F/G ratio of 2.69 and 2.75 respectively which were better ($P < .05$) than the F/G ratio of 3.69 for pigs on the 12% protein diet. Increasing antibiotic levels tended to improve F/G ratio at all dietary protein levels with the improvement greater at the lower dietary protein levels. Pigs receiving the 12% protein diet and 75g antibiotic per tonne of feed had better ($P < .05$) F/G ratio than those on the 15 and 18% protein diets.

The apparent dry matter and crude protein digestibilities of diets were not significantly affected by dietary protein and antibiotic levels. However, a consistent trend of increased dry matter and crude protein digestibilities was evident at all protein levels with increases in antibiotic additions to diet.

Discussion

Russo *et al.*, (1954) reported that in pigs fed levels of 10, 50 and 100mg of aureomycin/lb of feed, a significant difference between treatments in average daily gain was observed from weaning to 220lbs with the 50mg/lb supporting the most rapid gains. Wahlstrom (1956) studied the effects of varying levels of penicillin-streptomycin mixture in pig rations, and concluded that the addition of the antibiotics produced a highly significant increase in rate of gain with better feed conversion efficiency. This is similar to the observation made in the present study. Again, in the first experiment, maximum gain and efficiency of feed utilisation was achieved at 100g/tonne of feed and the fact that this gain was not significantly different from those obtained at 75g/tonne could suggest a plateauing of the response of the pigs to strepcillin at these levels. Most of the initial

response to antibiotic supplementation occurred early in the experimental period after which there was a plateauing of response. In other words, there may be no advantage in prolonged use of this antibiotic beyond the initial four week period. Scouring was not observed to be severe in the group of weanling pigs used probably because the level of sanitation adopted was high.

In the second experiment, the observed rates and efficiency of gain improved with increases in dietary protein levels. This is in contrast to what Ilori (1974) reported that optimum growth rate of local pigs was achieved at a lower than at a higher protein level. The observed rates of gain at the different protein levels was higher than those reported by Cameron and Ashton (1969) who reported an average daily gain of 0.25kg per day for local black pigs reared from weaning to 52.7kg live-weight in Ghana. Fetuga *et al.*, (1976) obtained a daily gain of 0.32kg for local pigs raised to about the same weight as the Ghana study. In our present study, a daily gain of 0.43kg was obtained in pigs receiving the 12% protein diet and 75g antibiotic per tonne of feed. The response in terms of improved performance to antibiotic levels, was greater at the lower than the higher protein levels. This is supported in the summary of all antibitic work by Carmpton and Harris (1969) who showed antibiotic feeding to reduce the amount of protein needed in pig rations, and that its greatest beneficial effect was during early growth as is the case in the present study.

		1	2	3	4	5	6	7	8	10
Yellow Maize	79.6	86.6	78.0	69.4	86.39	77.78	69.16	86.28	77.67	69.08
Groundnut Cake	11.0	9.0	17.6	26.2	9.0	17.6	26.2	9.0	17.6	26.2
Fish Meal	5.0	–	–	–	–	–	–	–	–	–
Dicalcium phosphate	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
Salt	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Mineral-Vitamin[1] Premix	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Antibiotic[2]		–	–	–	0.22	0.22	0.22	0.33	0.33	0.33

[1]The vitamin-mineral premix supplied 440mg riboflavin, 880mg calcium pantothenate, 2g niacine, 2.2g choline chloride, 15mg folic acid, 1mg Vit, B12, 5,000 I.U. Vitamin A, 6,600 I.U. Vit. D2 and 1,000 I.U. Vit. E per kg. diet. It also supplied 24ppm Cu, 2 ppm Iodine, 34ppm Mn, 50ppm Zn and 100pm Iron.

[2]To supply 50g/tone of feed , 2.0kg Strepcillin F-25 is required. This contains 8.33g penicillin and 41.67g Streptomycin. In trial 1, 0.11, 0.22, 0.33 and 0.44% Strepcillin F-25 were added to the basal diet to supply the antibiotic at levels 25, 50, 75 and 100g/tonne of feed in rations 2, 3, and 5 respectively.

TABLE 2: EFFECT OF STREPCILLIN ON PERFROMANCE OF WEANLING LOCAL PIGS

	Treaments				
	1	2	3	4	5
Strepcillin g/tonne of feed	0	25	50	75	100
Average daily gains (kg)	0.23^{a}	0.26^{a}	0.27^{ab}	0.30^{bc}	0.32^{c}
Average daily feed intake (kg)	0.88	0.89	0.91	0.91	0.90
Feed/Gain	3.83^{a}	3.42^{a}	3.37^{ab}	3.03^{bc}	2.81^{c}

^{abc}Means within horizontal rows with different superscripts are different ($P < .05$)

TABLE 3: THE EFFECT OF STREPCILLIN ON THE DEGREE OF SCOURING[1] IN WEANLING LOCAL PIGS

	Treatments				
	1	2	3	4	5
Strepcillin g/tonne feed	0	25	50	75	100
Week					
1	4.4	4.2	3.6	3.2	3.4
2	4.2	4.0	3.4	3.0	3.2
3	4.2	3.9	3.4	3.2	2.8
4	4.6	3.9	3.2	3.0	2.7
5	3.9	3.6	3.4	2.8	2.9
6	3.6	3.7	3.3	2.6	2.6
7	3.8	3.5	3.0	2.8	2.5
8	3.2	3.2	3.2	2.4	2.4
9	2.8	3.0	2.6	2.2	1.6
10	2.6	2.8	2.3	2.0	2.0
11	2.4	2.5	1.8	1.9	1.5
12	2.4	2.2	2.0	1.6	1.5

[1] 0 = No scouring

3 = Severe scouring

TABLE 4: EFFECT OF PROTEIN AND ANTIBIOTIC LEVELS ON PERFORMANCE OF WEANLING LOCAL PIGS

	Treatments								
	1	2	3	4	5	6	7	8	9
Protein level %	12	15	18	12	15	18	12	15	18
Antibiotic g/tonne feed	-	-	-	50	50	50	75	75	75
Performance Data									
Average daily gain (kg)	0.25^{a}	0.35^{b}	0.34^{b}	0.37^{bc}	0.37^{bc}	0.35^{b}	0.43^{c}	0.39^{bc}	0.38^{bc}
Average daily feed intake (kg)	0.92	0.94	0.94	0.93	0.94	0.92	0.93	0.93	0.94
Feed/Gain	3.69^{a}	2.69^{b}	2.75^{b}	2.51^{bc}	2.54^{bc}	2.65^{bc}	2.17^{c}	2.39^{bc}	2.47^{bc}
Apparent digestibility coefficients									
Dry matter, %	76.4	77.6	77.5	79.6	78.7	77.5	80.6	77.8	77.9
Crude protein %	74.8	75.3	75.3	77.8	76.5	75.8	78.4	76.4	75.4

^{abc} Means within horizontal rows with different superscripts are different ($P < .05$)

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