THE ADDITION OF BONE MEAL TO MEAT MEAL AND SOYABEAN MEAL DIETS FOR YOUNG PIGS

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Summary

An experiment was conducted to determine the effect of adding bone meal to wheat and meat meal based diets or wheat and soyabean meal based diets when fed to pigs from four to eight weeks of age.

The diets contained 0.80, 1.55 or 3.05% calcium and each diet was fed to eight pigs. The level of bone meal in the diets containing soyabean meal did not affect the growth rate of the pigs, but in the diets containing meat meal the addition of bone meal reduced weight gain and feed conversion efficiency. The digestibility of dry matter, nitrogen and calcium was significantly reduced by the addition of bone meal in both the soyabean meal and meat meal diets. There was no difference in the performance of the pigs fed the soyabean or meat meal based diets containing 0.80% calcium.

I. INTRODUCTION

Meat meals have been shown to be variable in composition (Duckworth, Woodham and McDonald 1961) and have often been considered unsatisfactory as the sole source of supplemental protein in the diets of growing pigs (Kennedy et al. 1974). Meat meals of moderate ash content have been shown to be superior to those of high ash content (Sathe and McClymont 1964). Also, it has been suggested that the poor performance of pigs fed diets containing meat meals is due to their poor protein quality (Kennedy et al. 1974).

The high ash content of meat meals is due to the inclusion of bone in the raw material for the manufacture of meat meal. Hence the present experiment was designed to determine the effect of increasing the bone content in the diet of pigs while maintaining an adequate level of lysine and methionine in the diets. Lysine and methionine are the first limiting amino acids in-meat meals (Kennedy et al. 1974).

11. MATERIALS AND METHODS

The experiment was of a randomized block design with six dietary treatments. The composition of the diets is presented in table 1. Bone meal was added to a meat meal based diet or a soyabean meal based diet to formulate three levels of calcium: 0.80, 1.55 and 3.05%. The meat meal used was manufactured from soft offal (stomachs and intestines) and the calcium content was low enough (3.59%) to allow supplementation with bone meal to the required levels. The meat meal was dry rendered at atmospheric pressure for three h and the final temperature reached during rendering was 120°C. The diets were equalised for crude protein (22%), calculated digestible energy (14.7 MJ/kg), total lysine (1.20%) and total methionine plus cystine (0.80%).

The diets were fed ad lib. to 48 cross-bred, male pigs, arranged in

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TABLE 1
Composition of diets (%)*

Ingredient	Diets					
	S1	S2	S3	M1	M2	M3
Wheat	64.6	59.7	50.0	77.4	72.0	62.6
Soyabean meal	27.3	27.1	26.6	-	-	-
Meat meal	-	-	-	21.0	20.7	20.4
Bone meal	2.9	6.1	12.3	0.1	3.7	9.5
Tallow	4.1	6.1	10.0	0.1	2.2	6.1
Salt	0.5	0.5	0.5	0.5	0.5	0.5
Premix*+	0.6	0.6	0.6	1.0	1.0	1.0

* Supplying per kg of diet: 11000 IU vit. A; 2200 IU vit. D_3; 1.1 mg vit. B_1; 3.3 mg vit. B_2; 1.1 mg vit. B_6; 22 µg vit. B_{12}; 6.6 mg vit. E; 2.2 mg vit. K; 11.0 mg calcium pantothenate; 3 mg riboflavin; 22 mg niacin; 44 mg Mn; 110 mg Zn; 330 mg Mg; 110 mg Fe; 11 mg Cu; 2.2 mg Co; 0.22 mg I; 100 mg ethoxyquin; 45 mg antibiotic
+ Contained L-lysine and DL-methionine supplement to equalize diets for lysine (1.20%) and methionine + cystine (0.80%)

TABLE 2
Pig performance and digestibilities*

	Diets							
	S1	S2	S3	M1	M2	M3	S	M
Average daily gain (g)	413.8^{ab}	403.5^{ab}	418.0^{a}	413.5^{ab}	352.5^{bc}	323.8^{c}	411.8^{1}	363.3^{2}
Average daily intake (g)	592.0^{a}	561.5^{a}	617.8^{a}	616.8^{a}	537.8^{a}	516.0^{a}	590.4^{1}	556.9^{1}
Feed conversion ratio	1.43^{ab}	1.40^{a}	1.49^{ab}	1.50^{abc}	1.53^{bc}	1.60^{c}	1.44^{1}	1.54^{2}
Dry matter digestibility (%)	87.2^{a}	84.4^{b}	77.6^{d}	85.5^{ab}	81.4^{c}	76.6^{d}	83.1^{1}	81.2^{2}
Nitrogen digestibility (%)	90.1^{a}	87.8^{b}	84.2^{c}	87.5^{b}	85.4^{c}	85.2^{c}	87.4^{1}	86.0^{2}
Calcium digestibility(%)	63.0^{a}	57.5^{ab}	44.1^{c}	56.7^{b}	43.9^{c}	43.9^{c}	54.9^{1}	48.2^{2}
Calcium absorption (g/d)	3.44^{a}	5.89^{b}	9.90^{d}	3.28^{a}	4.51^{ab}	7.75^{c}	6.41^{1}	5.18^{2}

* Values on the same line with the same superscript are not significantly different ($P<0.05$)

four blocks (blocked for weight), from four to eight weeks of age. Each diet was randomly allocated to one pen of two pigs within each block. Weight gain and feed consumption were recorded weekly and all faeces were collected in the second and fourth weeks of the experiment,

Feed and faeces samples were dried to constant weight at 95°C. Nitrogen was measured by Kjeldahl techniques, calcium by an atomic absorption spectrophotometer and amino acids on a Technicon T.S.M. analyser after hydrolysis in 6N HCl for 24 h at 110°C.

Differences between diets were tested by an analysis of variance and treatment means were separated by Duncan's Multiple Range Test (Steel and Torrie 1960).

III. RESULTS

The average daily gain and feed conversion efficiency of the pigs fed the soyabean meal based diets were better than those of the pigs fed the meat meal based diets (table 2). The weight gain of the pigs was not significantly affected by the level of bone meal included in the soyabean meal diets, but growth rate was depressed when 3.7 or 9.5% bone meal was added to the meat meal diets. The weight gain and feed conversion efficiency of the pigs fed the meat meal diet with the lowest level of bone meal (M1) was equal to that of the pigs fed the soyabean meal diets.

The digestibility of dry matter, nitrogen and calcium was greater for the soyabean meal based diets than the meat meal based diets although all digestibilities were depressed by the addition of bone meal. The absorption of calcium increased as the level of calcium in the diet increased,

IV. DISCUSSION

In the present experiment the level of bone meal added to the meat meal diets was at a concentration which is similar to that measured in commercial meat and bone meals (Leibholz and Moss 1967). The level of bone meal in the soyabean meal basal diets fed to the pigs did not affect their performance as is also shown by Kennedy et al. (1974). This appears that the tolerance of pigs to high calcium levels is greater than in the rat (Kennedy et al. 1974) or the chick (Batterham, Manson and Kirton 1970). Undoubtedly, the absence of an effect of high calcium levels is dependent upon adequate dietary levels of other minerals (Davis 1959) and vitamins (Sathe and McClymont 1965).

The reduced performance of the pigs fed the diets containing high levels of bone meal added to the meat meal based diet may be partly due to the depression of feed intake although the differences in intakes on the diets were non-significant. Also, the reduction in pig performance may be due to an imbalance of the essential amino acid content produced by the bone meal (Eastoe and Long 1960). The total essential amino acid content of the meat meal diets was less than that of the soyabean meal diets except for lysine and methionine. The addition of bone meal depressed the digestibility of dry matter and nitrogen to a similar extent in the soyabean meal diets as the meat meal diets without depressing growth in the former.

At the lowest level of bone meal inclusion pigs fed the meat meal based diet performed as well as pigs fed the soyabean meal based diet, The meat meal was manufactured from soft offal and Skurray and Herbert

(1974) reported that these meat meals were superior in nutritional value to those manufactured from hard offal. This effect was due to the higher content of available essential amino acids in the soft offal,

In conclusion, it is suggested that the performance of pigs between four and eight weeks of age fed diets containing meat meal or soyabean meal ad lib. is similar if the level of bone included in the diets is low. However, further experiments are required to compare "boneless" meat meals with other meat meals and meat and bone meals.

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