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A. L. PALAFOX, Ph.D.

ABSTRACT

Two experiments were conducted to determine the effect of dietary coconut meal on body weight, feed consumption and efficiency of growing pigs. In the first experiment data obtained from 9 kg pigs showed that up to 15 percent coconut meal may be used without significantly affecting average daily gain, feed consumption and feed efficiency. In the second experiment, 24 kg pigs showed that up to 25 percent coconut meal may be used without significantly affecting final weight, daily weight gain and feed consumption. Feed efficiency of pigs fed 0 percent coconut meal was significantly superior to those fed 15, 25, and 35 percent coconut meal.

It was concluded that swine performance decreased with increase in the level of coconut meal in the diet. As much as 15 percent coconut meal may be incorporated in the diet of 9 kg growing pigs with minor reduction in performance. Moreover, as much as 25 percent coconut meal may be used in the diet of 24 kg pigs without significantly affecting productive performance.

Fifteen percent coconut meal replaced 7.5 percent cottonseed meal without significantly affecting performance of 9 kg pigs.

Contents

INTRODUCTION

Coconut meal is a protein concentrate. It is the residual product after the extraction of the dried meat of coconut, Cocos nucifera, and is available in many parts of the world including the Caribbean Islands, Micronesia and the Philippines. It may be one of the few important sources of protein in large areas of the Tropics. Even thought the meal contains moderate levels of Crude protein, 20-26 percent, about 6 percent of other extract when expeller processed and about 10 percent crude protein, it is an economically important source of protein in areas in which other sources are not readily available (Pond and Maner, 1974).

Loosli et al. (1954) reported that digestibility of coconut meal protein was 73 percent when pigs were used as test animals. Butterworth and Fox (1963) noted that the digestibility of coconut meal decreased with increase in processing temperature. There was a corresponding reduction in available lysine and net protein utilization as the temperature was increased. Creswell and Brooks (1971a) found that crude protein in coconut meal was only 50.7 percent. They attributed the low digestibility to the processing method.

The supplementary value of coconut meal may vary with the feed ingredients in the diet. Grieves et al. (1966) reported that each level of coconut meal used to replace soybean meal caused a decrease in pig gain. Creswell and Brooks (1971b) noted that up to 20 percent coconut meal caused only minor reductions in pig performance. Loin eye area was reduced at high levels of coconut meal. Forty percent

coconut meal reduced pig gain by 39.5 percent. Supplementary lysine had no effect when the diets contained 20 or 40 percent coconut meal (Creswell and Brooks, 1971a). The same authors suggested that some factor other than lack of adequate protein or lysine may be responsible for the growth depressing effect of coconut meal. Pond and Maner (1974) reported that except in unusual circumstances of price realationship and availability of protein supplements, coconut meal should not be included in proportions of more than 15 to 20 percent, in growing-finishing diets if maximum performance is to be expected.

Materials and Methods

Experiment 1. Forty purebred pigs were distributed at random by sex and weight into eight pens. There were four pens of males, five each. There were also four pens of five females each. Diets one through four were randomly assigned to each of the four pens of males and four pens of females. Feed and water were provided ad libitum. Body weight and feed consumption data were obtained weekly for a period of five weeks. Table 1 shows the diet composition and Table 2 shows nutrient composition of diets in experiment 1.

Experiment 2. Twenty-four purebred growing pigs were distributed at random by sex and weight into four pens. There were three males and three females in each pen. Diets 5 throught 8 were assigned at random. Feed and water were provided ad libitum. Weekly data were obtained on body weight and feed consumption for a period of five weeks. The composition of diets used in experiment 2 is shown in Table 3 shows whereas the nutrient composition is shown in Table 4.

The data were analyzed statistically according to the variance analysis reported by Snedecor and Cochran (1967). The signficance of means was calculated according to Duncan's multiple range test (1955).

Table 1. Composition of diets used in experiment 1 (%)

Diets	1	2	3	4
Ingredients				
Coconut meal	0.00	10.00	15.00	20.00
Corn	80.13	75.13	57.63	70.13
Cottonseed meal	10.00	5.00	7.50	0.00
Meat and bone meal	9.25	9.25	9.25	9.25
Micromix[1]	0.25	0.25	0.25	0.25
Bacifern	0.02	0.02	0.02	0.02
Salt	0.35	0.35	0.35	0.35
TOTAL	100.00	100.00	100.00	100.00

[1] Supplies the following per kg diet: Vitamin A, 2202 IU; Vitamin D_3, 442 IU; Vitamin E, 4.42 IU; Vitamin E, 4.4 IU; Vitamin B12, 8.8 mcg; Ribofavin, 17.6 mcg; Niacin, 13.2 mg; d Pantothenic acid, 6.6 mg; Choline, 88.1 mg; d Biotin, 22 mcg; Mn, 48 mcg; Zn, 46 mcg; Fe, 16 mcg.

Table 2. Calculated composition of diets used in experiment 1 (%)

Diets	1	2	3	4
Nutrients				
Crude protein	16.07	15.53	15.18	15.00
Calcuim	1.02	1.06	1.09	1.11
Phosphorus	0.59	0.58	0.57	0.56
Methionine	0.27	0.26	0.25	0.25
Cystine	0.21	0.26	0.23	0.24
Lysine	0.64	0.62	0.60	0.59
Fiber	3.08	3.83	4.18	4.58
ME (kcal/kg)	3107	2999	2949	2890

Table 3. Composition of diets used in experiment 2 (%)

Diets	5	6	7	8
Ingredients				
Coconut meal	0.00	15.00	25.00	35.00
Corn	20.00	20.00	17.00	17.00
Milo	47.83	45.58	40.85	34.33
Peanut Meal	6.50	8.75	6.50	3.00
Safflower	15.00	0.00	0.00	0.00
Meat & bone meal	1.50	1.50	1.50	1.50
Alfalfa meal	2.50	2.50	2.50	2.50
C - 1 concentrate	5.00	5.00	5.00	5.00
Limestone	1.00	1.00	1.00	1.00
Dicalcium phosphate	0.25	0.25	0.25	0.25
Vi-min mix[1]	0.20	0.20	0.20	0.20
Bacifern	0.02	0.02	0.02	0.02
Salt	0.20	0.20	0.20	0.20
Total	100.00	100.00	100.00	100.00

[1] Supplies the following per kg diet: Vitamin A, 2202 IU; Vitamin D_3, 442 IU; Vitamin E, 44 IU; Vitamin B12, 88 mcg; Rilbo Flavin, 176 mcg; Niancin, 13.2mg; d Patothenic acid, 6.6 mg; Choline, 88.1 mg; d Biotin, 22 mcg; Mn, 48 mcg; Zn, 46 mcg; I, 1 mcg; Co, 4 mcg.

Table 4. Calculated composition of diets used in experiment 2 (%)

Diets	5	6	7	8
Nutrients				
Crude protein	16.42	16.55	16.89	16.72
Calcium	0.55	0.54	0.55	0.56
Phosphorus	0.36	0.36	0.37	0.37
Methionine	0.16	0.19	0.21	0.21
Cystine	0.18	0.24	0.24	0.23
Lysine	0.33	0.46	0.47	0.46
Fiber	2.44	4.80	5.99	7.11
ME (kcal/kg)	2606	2704	2538	2364

Results and Discussion

Experiment 1. The data in Table 5 summarize the performance of pigs weighing 8.67-9.28 kg at the start of the 35-day test period. The initial weights were similar as expected. Final weight of pigs fed 0, 10, 15, and 20 percent coconut meal averaged 16.28, 19.12, 15.07, and 15.51 kg, respectively. Although there were no significant differences among treatment means, pigs fed 10 percent coconut meal were the heaviest. They weighed 17 percent more than the control. Final weight of pigs fed 10, 15 and 20 percent coconut meal tended to decrease with increase in the level of coconut meal in the diet.

Average daily gain ranged from 0.17 kg to 0.28 kg. Pigs fed 10 percent coconut meal were the heaviest, 40 percent heavier than the control. Those fed 20 percent coconut meal gained the least and were 15 percnet lighter than those fed 0 percent. The preceeding data are in agreement with those reported by Grieves et al. (1966) and Creswell and Brooks (1971a) who found that final weight of pigs decreased with increase in coconut meal in the swine diet.

It was noted that the daily gain was low, 0.17-0.28 kg. The low daily gain was attributed to the low protein concentration in the test diets (16%), instead of the 18% protein that normally would be used for the weight class of pigs used in present study. The lower protein concentration of protein was used for it was expected that the differences in performance show up better at the lower protein level.

Daily feed consumption was significantly affected by the level of coconut meal in the diet. Feed consumption decreased with increase in the level of coconut meal from 10-20 percent. Pigs fed 20 percent

Table 5. Summary of swine performance in experiments 1[1]

Diets	1	2	3	4
Copra Meal, %	0	10	15	20
No. of pigs	6	6	6	6
Days on test	35	35	35	35
Av. Init. Wt., kg	9.20(100)	8.99(98)	8.67(94)	9.28(101)
Av. Final Wt., kg	16.28(100)	19.12(117)	15.07(93)	15.51(95)
Av. Daily Gain, kg	0.20(100)	0.28(140)	0.18(90)	0.17(85)
Av. Daily Feed, kg	0.76(100)^{ab}	0.85(112)^{b}	0.72(95)^{ab}	0.70(92)^{a}
Feed/Gain Ratio	3.78(100)^{ab}	3.02(78)^{a}	4.02(106)^{ab}	4.69(124)^{b}

[1] Means within the same catergory bearing different letters are significantly different (P. 0.05).

( ) Relative value, %

coconut meal consumed significantly less feed than those fed 10 percent. Those fed 0-15 percent coconut meal consumed similar amounts of feed.

The data in experiment 1 suggest that in areas where coconut and cottonseed meals are economically available, the two protein concentrates may be used to supplement each other in swine grower rations. Moncada and Maner (1970) reported similar gains and feed efficiency were obtained from pigs fed up to 11.41 percent cottonseed meal. Hale and Lyman (1957) reported that growing swine tolerates cottonseed meal if the level of protein in the diet is increased. Kornegay et al. (1961) observed that toxicity of free gossypol in cottonseed meal as measured by feed intake was influenced by source of protein and level of gossypol. Twenty percent coconut meal in pig rations may be used with insignificant effects on performance according to Creswell and Brooks (1971a).

Experiment 2. Summary of the performance of growing swine fed 0 to 35 percent coconut meal is shown in Table 6. The average initial weights ranged from 24.31 to 26.27 kg. As expected there were no significant differences among means. Average final weight at the end of the 35-day experimental period was 42.00, 41.68, 41.08, and 36.36 kg, respectively, for pigs fed 0, 15, 25, and 35 percent coconut meal. Final weights decreased with increase in the level of coconut meal in the diet. The preceeding data also corroborates those reported by Creswell and Brooks (1971a) and Grieves et al. (1966). They used different levels of coconut meal for growing-finishing swine.

Average daily gains ranged from 0.32 to 0.44 kg. Gain was highest for pigs fed 0 percent coconut meal. Those fed 35 percent

Table 6. Summary of swine performance in experiments 2[1]

Diets	5	6	7	8
Copra Meal, %	0	15	25	35
No. of pigs	10	10	10	10
Days on test	35	35	35	35
Av. Init. Wt., kg	25.09(100)	26.27(102)	25.73(103)	24.31(97)
Av. Final Wt., kg	42.00(100)	41.68(99)	41.08(98)	36.36(97)
Av. Daily Gain, kg	0.44(100)	0.40(91)	0.41(93)	0.32(73)
Av. Daily Feed, kg	1.44(100)^{b}	1.57(109)^{bc}	1.67(116)^{bc}	1.26(98)^{a}
Feed/Gain Ratio	3.37(100)^{a}	3.93(117)^{b}	4.06(120)^{b}	3.94(117)^{b}

[1] Means within the same catergory bearing different letters are significantly different (P. 0.05).

( ) Relative value, %

coconut meal gained the least. Average gains of pigs fed 15 and 25 percent were intermediate between those fed 0 and 35 percent coconut meal. As in experiment 1 weight gain data in experiment 2 support the observation of Creswell and Brooks (1971a) and Grieves et al. (1966) that each level of coconut meal replacing soybean meal decreased weight gain.

Level of coconut meal in the pig diet significantly affected daily feed consumption. Pigs fed 0 to 25 percent coconut meal increased their feed consumption with each increase in the level of the protein concentrate. It was also noted that those fed the 35 percent coconut meal consumed the least feed. The low feed consumption was attributed to the high fiber concentration (7.11%) compared to pigs fed 0 to 25 percent (3.08-4.18%). The high concentration of coconut meal (35%) was not sufficiently agreeable to the taste of the pigs so that they consumed significantly less feed than those fed 0 to 25 percent. As a consequence of low feed consumption the pigs fed the 35% coconut meal did not consume sufficient nutrients required for optimum weight gain.

Feed gain ratio ranged from 3.37 to 4.06. Feed conversion of pigs fed 0 percent coconut meal was significantly better (3.37) than those fed 15 to 35 percent coconut meal (3.93-4.06). Those fed 15 and 25 percent coconut meal were not significantly different in feed efficiency. It was noted that pigs fed 15-35 percent coconut meal consumed 17-20 percent more feed per unit of gain than the control.

Under the conditions of the present study, 15 percent coconut meal caused a minor reduction in pig performance. However, 35 percent coconut meal caused a 27 percent reduction in daily gain and a 17 percent increase in feed required per unit of gain.

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