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MOHD. YUSOFF B. AHMAD

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BY
MOHD. YUSOFF B. AHMAD

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ABSTRACT

The study was conducted to evaluate the nutritive value of palm kernel cake in broiler ration. The experiment was carried out using isocaloric and isonitrogenous diets containing 0, 10, 20 and 30% palm kernel cake. 240 ANS broiler chicks were fed these diets from 15 days to 56 days of age. The results showed that liveweight gain and feed conversion were significantly different among the dietary treatments, the lowest level of palm kernel cake giving the best rate and efficiency of gain. Feed intake and dressing percentage were not significantly influenced by dietary treatments. Birds consumed the least on ration containing 30% palm kernel cake. Percentage of fat and skin tended to decrease and that of lean meat increased as the level of palm kernel cake increased, only the differences for lean meat percentage were however significant. Cost per kg feed increased and nett profit decreased as increasing maize fraction was replaced by palm kernel cake. There was no economic advantage of using palm kernel cake over maize and soybean. A ration containing up to 30% palm kernel cake could be incorporated into broiler diet without markedly affecting the economic of production.

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INTRODUCTION

The livestock industry in Malaysia is expanding rapidly to meet the growing needs of the increasing population. This inevitably demands a greater supply of feedstuffs for the animals.

At present, Malaysia in largely dependent on imported feedstuffs for her livestock industry. More than three quarter of these feedstuffs is imported costing nearly 93 million Malaysian ringgits annually. Of this more than half is for poultry industry. Some of the feedstuffs can be substituted by locally produced raw materials.

In many parts of the tropics including Malaysia, where the emphasis is in agriculture, there is often an abundance of crop residues produced which potentially are very valuable animal feeds. Unfortunately, due to limited information on their effective utilization and the ease of continued dependence on imported feedstuffs, despite the high cost, only a limited use is made of these by-products.

One of the agricultural by-products which is produced in large quantity in Malaysia is palm kernel cake. It has been estimated that Malaysia produced a total of 270,600 tonnes of air dry palm kernel cake in 1979 (Devendra, 1977). The production is projected to reach 334,700 tonnes by 1981. If palm kernel cake can be efficiently utilized for animal feeding, it will save Malaysian foreign exchange, provide a cheaper and readily available source of animal feed ingredient as well as rendering this country less dependent on imported animal feedstuffs.

The objectives of this study were to evaluate the feeding value of palm kernel cake in broiler diets.

LITERATURE REVIEW

Palm kernel cake is a valuable source of energy and protein. The protein content is low but the quality is high (Devendra, 1977). Oluyemi et al.(1976) and Devendra (1975) found that palm kernel cake contains 18.7% and 19% crude protein, respectively. The palm kernel cake from Elaeis Oleifera and its hybrids have a significantly lower content of protein than that of E. quineensis (Quraishi and Macfarlane, 1975). This shows that protein content of palm kernel cake varies with the species of oil palm. Owosu-Domfeh et al.(1970) and Fetuga (1972) found that palm kernel cake contains sufficient methionine and cystine but marginal in lysine content.

The fibre content of palm kernel cake, 13.0% (Oluyemi et al., 1976) reduces its apparent digestibility and renders it less suitable for feeding non-ruminants (Devendra, 1977). Its utilization by young pigs and poultry has been impaired by its grittiness and high crude fibre content (Oyenuga, 1968). For this reason, palm kernel cake is more commonly fed to ruminants, especially dairy cows. However, in Malaysia, the number of trials done on utilization of palm kernel cake by ruminants is very limited.

Palm kernel cake has been utilized as a source of protein for animal feed in various countries, particularly Nigeria. Fetuga et al. (1973) showed that good liveweight gain can be obtained in rats.

By Comparison with pigs (Fetuga et al., 1977) poor utilization and weight loss from feeding palm kernel cake was demonstrated.

Liveweight gain and feed efficiency of finishing pigs were markedly influenced by palm kernel cake and blood meal, the lowest level of palm kernel cake giving significantly the best rate and efficiency of gain (Fetuga et al., 1977). In addition, there was tendency for carcass leaness to improve as the proportion of dietary protein supplied by palm kernel cake increased. Carcass cuts did not appear to be influenced by the level of palm kernel cake in the diets except for percent fat cuts which decreased significantly ($P < 0.05$) as the dietary levels of palm kernel cake increased. In another experiment, Babatunde et al. (1975) showed also that blood meal enhanced the utilization of palm kernel cake-based diets.

Additionally, palm kernel cake is also being used in diets for broilers and layers. Preliminary indications suggested that palm kernel cake could be used up to 30% in broiler diets (Yeong, 1977). Thomas (1978) found that digestibility of hay and straw increased as a result of alkali treatment. Heifers showed improved daily gain when fed with these materials. However, Nwokolo et al. (1977) demonstrated that broilers failed to show improved performance when fed with alkali-treated palm kernel cake.

In another experiment, Armas, A.E. and Chico, C.F. (1977) showed that liveweight of chickens at 4 and 6 weeks of age decreased as dietary palm kernel cake increased, regardless of fish meal, lysine and methionine supplementation. The effects of the supplementation were significant only with 45% palm kernel cake-based diet.

MATERIALS AND METHODS

Four diets were used and composition of each of the diets is shown in Table 1. Palm kernel cake was incorporated in diet 1, 2 and 3 at the level of 10, 20 and 30% respectively, in partial replacement of soybean and maize. The control diet contains no palm kernel cake. The rations were isocaloric (3000 kcal. M.E/kg.) and isonitrogenous (24% protein) Minerals and vitamins were adequately supplied. The rations were formulated on the basis of the values given by W. Bolton and J. Blair (1974). Chemical analysis for the feeds were carried out according to A.O.A.C (1965) methods and the values are given in Table I. Crude protein, calcium and phosphorus were determined by autoanalyser.

The experiment was conducted at the University Farm. A total of two hundreds and forty ANS 100 chicks were used in this experiment. For the first two weeks of life, the chicks were raised in a brooding compartment and fed on commercial starter diet. Artificial heat was provided only during the night and rainy days. At fifteen days of age, the chicks were weighed and allotted to cages using a completely randomized design. The treatments were replicated six times with ten birds per replicate. The cages were located in an open-type poultry house, arranged in two rows of forteen in each and about 91 cm. above a cemented ground. Each cage measuring 122 x 122 x 55 cm, giving a floor area of 14,884 cm^2. The cage floor and wall were made up of B.R.C wire mesh of 5 x 2.5 cm and 5 x 5 cm, respectively. Each cage had a 122cm long feed trough and all the cages in the row shared a

common long water trough. The cages on either row received direct sunlight in the morning and late afternoon.

The experiment commenced from day 15 and terminated on day 56. Feed and water were supplied ad libitum. Artificial light was provided from 1900 to 0700 hour throughout the experimental period. The birds were vaccinated against Newcastle disease at one week of age and repeated at the age of 28 days together with fowl pox vaccination. Antistress (A-R-N Protector, ICI) was given in drinking water for three consecutive days following the vaccination.

Liveweight and feed intake were recorded at biweekly intervals. At the end of the experimental period (day 56), one bird from each replicate was randomly selected, slaughtered and dressing percentage was determined. Three dressed birds from each treatment were taken for determination of carcass composition in terms of percentage of lean meat, skin, bone and fat. For this purpose, the four components of the carcass were separated using a knife, weighed separately and the percentage determined in term of the weight of the dressed birds. Economics of broiler production was calculated. Daily liveweight gain, daily feed intake, feed conversion and carcass composition were statistically analysed using analysis of variance and Duncan's new multiple range test as described by Steel and Torrie (1960).

Table 1. Formulated percentage composition and chemicals analysis of experimental diets

Ingredients	Diet C	Diet 1	Diet 2	Diet 3
Palm kernel cake (%)	0	10	20	30
Maize (%)	47.0	35.0	22.54	11.06
Soybean meal (%)	45.20	44.20	43.16	41.88
Palm Oil (%)	4.80	7.80	11.30	14.06
Dicalcium phosphate (%)	1.5	1.5	1.5	1.5
Limestone (%)	0.7	0.7	0.7	0.7
Salt (%)	0.2	0.2	0.2	0.2
Vitamin-mineral premix* (%)	0.1	0.1	0.1	0.1
Calculated values				
Energy, metab. (kcal/kg.)	2995	2998	2993	2996
Protein (N x 6.25, %)	23.97	24.0	24.0	23.95
Lysine (%)	1.48	1.47	1.45	1.44
Methionine (%)	0.47	0.48	0.49	0.51
Analysed Values				
Energy, metab. (kcal/kg)	2996	3001	2990	2994
Protein (N x 6.25, %)	23.90	23.96	23.97	23.98
Crude fibre (%)	3.6	4.4	5.1	5.7
Crude fat (%)	7.01	9.78	12.32	15.27
Calcium (%)	0.72	0.74	0.75	0.77
Phosphorus (%)	0.68	0.69	0.70	0.70
Ash (%)	5.88	6.03	6.33	6.60
Moisture (%)	9.28	8.56	8.40	8.58

* Adiuvit®

RESULTS

A. NUTRITIONAL VALUE OF PALM KERNEL CAKE

The results of performance of broilers on palm kernel cake is shown in Table 2. Daily feed intake was not statistically significant ($p < 0.05$) between treatments. However, feed consumption was the least on the diet containing the highest level of palm kernel cake. The amount of feed consumed was about 86 to 89 g/bird/day.

Table 2: Performance of broilers on dietary palm kernel cake

Performance Charcteristic	Diet C	Diet 1	Diet 2	Diet 3
Feed intake (g/bird/day)	88.59±0.79	89.47±1.08	89.17±0.57	86.00±1.48
Liveweight gain (g/bird/day)•	37.75 ± 0.55^{a}	37.21 ± 0.46^{ad}	35.17 ± 0.37^{cd}	31.69 ± 0.57^{b}
Feed/gain•	2.35 ± 0.02^{ae}	2.40 ± 0.01^{ce}	2.54 ± 0.02^{d}	2.72 ± 0.02^{b}

•Significance of treatment differences at $p < 0.01$

Means in the same row without common superscripts are significantly different ($p < 0.01$)

There was a significant different ($p < 0.01$) in average daily gain between the treatments. The results showed a consistent decrease in average daily gain as the level of palm kernel cake in the diets increased. Compared with average daily gain by birds on the control diet, there was a significant decrease ($p < 0.01$) in gain except birds on diet 1. The average daily gain by chickens on the 10, 20 and 30% palm kernel cake diets were respectively 2, 7 and 16% lower than that

by the chcikens on the control diet. There was also significant difference ($p < 0.05$) between average daily gain of birds fed with diet 1, 2 and 3 (Table 2). The highest daily gain was found in birds on the control diet. This was reflected in higher liveweight of birds fed this diet in comparison with the other diets as shown in Fig. 1. The final liveweight of birds on diet C, 1, 2 and 3 were 1.79, 1.77, 1.68 and 1.53 kg, respectively. Feed conversion of chickens on the control diet was significantly superior ($p < 0.01$) than the other diets. There was no significant difference between the control diet and diet 1.

B. ECONOMIC EVALUATION OF PALM KERNEL CAKE

The economic performance data is shown in Table 3. The respective nett profit for diet C, 1, 2 and 3 were M$1.78, M$1.67, M$1.36 and M$0.94. Thus, the birds on the control diet gave the highest profit. This was attributed to the high daily weight gain and low feed conversion of birds on control diet when compared with diets 1, 2 and 3. However, the inclusion of up to 30% palm kernel cake into the diet still resulted in a nett profit of M$0.94 per bird.

C. CARCASS COMPOSITION

Table 4 summarizes the gross carcass composition for the different dietary treatments. Percentage lean meat was significantly influenced ($p < 0.01$) by dietary treatments. The carcass of birds receiving diet 3 had a significantly higher content of lean meat than those on diet 2 but not those on diet C and 1. Dressing percentage and percentage of bone, fat and skin were not significantly different between the treatments. However, there was a tendency towards a decrease in percentage of fat and skin as the level of palm kernel cake increased.

Table 3: Economic performance of broilers on palm kernel cake

Item	Diet C	Diet 1	Diet 2	Diet 3
a) Cost of day-old chick (M$)	0.80	0.80	0.80	0.80
b) Cost of starter diet (M$)	0.145	0.145	0.145	0.145
c) Cost of experimental diet (M$)	2.277	2.313	2.355	2.343
d) Overhead cost (M$)* (10% of a+b+c)	0.322	0.326	0.330	0.329
Total	3.544	3.584	3.630	3.617
a) Average final liveweight (kg)	1.790	1.767	1.680	1.535
b) Selling price (M$/kg liveweight)**	2.970	2.970	2.970	2.970
c) Selling price (M$/bird)	5.320	5.250	4.990	4.560
Nett profit per bird (M$)	1.776	1.666	1.360	0.943
Nett profit for 1,000 birds (M$)	1776	1666	1360	913

** Selling price of chicken per kg. liveweight was at M$2.97, based on market price on 12th December, 1979.

* Overheads include building depreciation, water, electricity, medication and labour. Based on the suggestion by Raghavan et al., 1978, overheads ranged from 8-12% of the total cost.

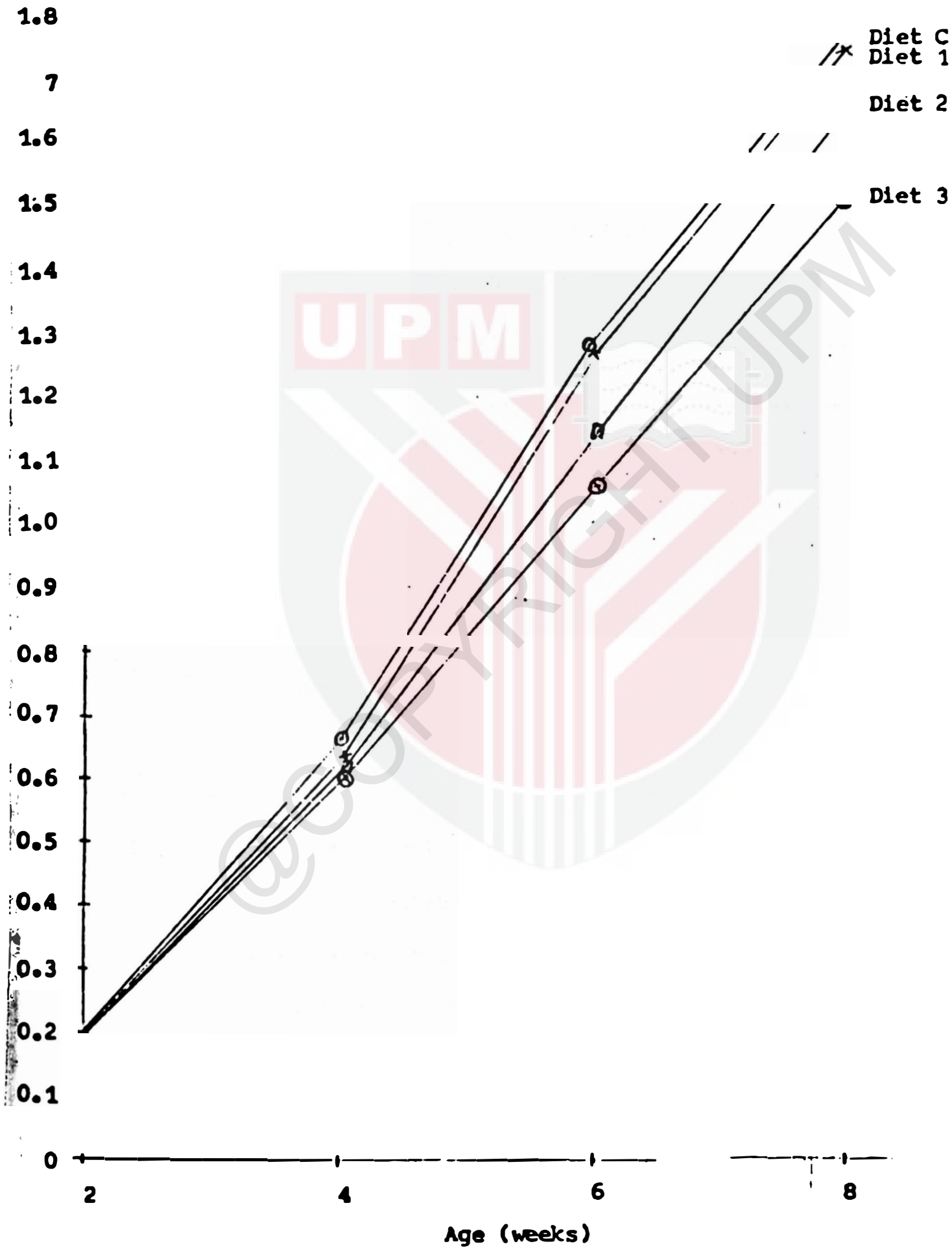

Fig. 1. Effect of varying levels of palm kernel cake on liveweight of broilers at various ages

Table 4: Carcass Composition of broilers fed palm kernel cake diets

Item	Diet C	Diet 1	Diet 2	Diet 3
Lean meat (%)•	48.76±0.76 bc	49.58±0.70 b	45.06±1.12 ac	51.56±0.96
Fat (%)	5.93±0.94	6.00±0.88	5.85±0.73	5.80±0.69
Skin (%)	11.94±1.22	11.76±1.37	11.69±1.23	11.60±1.03
Bone (%)	16.54±0.79	16.61±0.66	16.54±0.74	16.44±0.54
Dressing (%)	76.42±1.42	76.84±1.13	76.57±1.31	75.88±1.27

• Significance of treatment differences at $p < 0.01$

Means in the same row without a common superscript are significantly different at $p < 0.01$

DISCUSSION

A. NUTRITIONAL VALUE OF PALM KERNEL CAKE

The results showed a decline in the rate of liveweight gain and progressively decreasing feed conversion efficiency as the proportion of palm kernel cake increased in the diets. This could be due to the low digestibility of palm kernel cake as had been shown be impaired by its fibre content (Fetuga, 1972). The inclusion of progressively higher quantities of palm kernel cake into the diets therefore, may have reduced the extent to which the nutrients, particularly the protein fraction, are digested. This impaired protein digestion could result from an encrusting effect of fibre on intracellular proteinaceous material. In addition, impaired feed digestion could also be attributed to a faster rate of passage of the

feed through the alimentary canal.

The decrease in feed digestibility leads to a reduction of available nutrients such as amino acids, which would tend to be more serious when more palm kernel cake was included. This accounts for the significant reduction in growth rate and worsening of feed efficiency. These findings were in agreement with that of Hedge et al., (1978) and Bayer et al., (1978) who concluded that performance of broilers deteriorated as dietary crude fibre increased.

B. ECONOMIC EVALUATION OF PALM KERNEL CAKE

Palm kernel cake was incorporated at increasing level from diet 1 to diet 3, in partial replacement of maize. The level of soybean was only slightly affected. As a result, increasing amount of palm oil had to be incorporated into these diets to make up for energy deficit. Although the price of palm kernel cake (M$0.28/kg) was lower than that of maize (M$0.41/kg), the inclusion of palm oil, the price of which was M$1.25/kg, caused diets 1, 2 and 3 to cost more per unit weight than that of the control diet. The respective price per kilogram of diet C, 1, 2 and 3 were M$0.62, M$0.63, M$0.64 and M$0.65. This, in the addition to the depressed production performance of birds fed palm kernel cake, resulted in decreased nett profit as the level of palm kernel cake increased.

C. CARCASS COMPOSITION

The results showed that most of carcass traits excdpt percentage of lean meat were not significantly influenced by diets. Increasing the level of palm kernel cake resulted in increased dietary crude

fibre (Table 1) which exert its effect on carcass composition by inhibition of fat deposition. This explains the decreasing trend of the percentage of fat and skin observed as the level of palm kernel cake increased.

Several studies (Cooke et al., 1972) had shown that high lysine concentration encourage muscle development. In another experiment, it was shown that high lysine diet resulted in higher liveweight gain and carcass protein content (Grigor'ev et al., 1978). These authors stated that lysine and methionine, when adequately supplied in diets, increased the rate of biosynthesis of some cytoplasmic protein in muscle thus intensifying muscular tissue deposition. The diets containing a larger amount of palm kernel cake had a higher level of dietary methionine but lower in lysine (Table 1). The interaction between the effect of dietary lysine and methionine could have contributed to the result obtained for the percentage of lean meat.

CONCLUSION

It was concluded that up to 30% palm kernel cake could be used in broiler diet. There was no economic advantage of replacing maize and soybean meal with palm kernel cake. However, in times when the cost of maize and soybean for use in poultry diet becomes acute or there is a shortage of maize and soybean meal supply, it would be apparent that palm kernel cake can be a good substitute.

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