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AMINO ACID AVAILABILITY OF PALM KERNEL CAKE, PALM OIL SLUDGE AND SLUDGE FERMENTED PRODUCT (PROLIMA) IN STUDIES WITH CHICKENS

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Keywords: Amino acid availability, Palm kernel cake, Palm oil sludge, Sludge fermented product (PROLIMA), Chickens

RINGKASAN

Kandungan asid amino dan kadar kehadamannya dalam hampas isi kelapa sawit, hampas minyak kelapa sawit dan 'Prolima' (bahan keragian hampas minyak kelapa sawit) di dalam makanan ayam telah dikaji. Didapati kandungan asid amino dari hampas isi kelapa sawit dan hampas minyak kelapa sawit merupakan bahan-bahan sambilan bijirin. Manakala 'Prolima' mempunyai kandungannya di antara kandungan hampas kacang tanah dan hampas kacang soya.

Didapati juga peratus kadar kehadaman asid amino di dalam hampas isi kelapa sawit dan hampas minyak kelapa sawit dan 'Prolima' adalah masing-masing 64.4, 24.8 dan 71.0%. Di samping kemungkinan penggunaan bahan-bahan tersebut ke dalam makanan ayam, masalah mengenai kandungan asid aminonya juga dibincangkan.

INTRODUCTION

The protein content and other proximate values of palm kernel cake (PKC) and dried palm oil sludge (POS) have been reported (WEBB *et al.*, 1975; DEVENDRA and MUTHURAJAH, 1976; YEONG, 1981). It was found that the PKC and POS could only be used to certain low levels in chicken diets, i.e. 10% for POS and 10–20% for PKC (YEONG, 1981). The limitation for using these ingredients could be attributed to their higher fibre and ash contents and also possibly the lower availability of their protein content. In other words, the amino acid quality and digestibility could also play a vital role in their utilization.

In view of this, a measurement for amino acid content and their bioavailability from these two ingredients together with a sludge fermented product ('Prolima') in chickens were carried out. Four-week-old broiler chicks were used as experimented animals for the test.

MATERIALS AND METHODS

In this test, the PKC used was obtained by solvent extraction. POS was from the centrifugation process followed with drying in a rotary drum. POS fermented product ('Prolima') was obtained from Dunlop Estate Limited. The amino acid content of these three ingredients were determined by hydrolysis and column chromatography according to the method described by MOORE and STEIN (1951).

The availability of amino acids in PKC, POS and 'Prolima' were determined according to the procedures described by BRAGG *et al.*, (1969). During this test, 48 four-week old broiler chicks of approximately the same weight were selected. They were previously fed a starter diet containing 23% crude protein and 2,980 kcal/kg ME up to 28 days old *(Table 1)*. From 21st day onwards, the chicks were distributed into individual cages. At the end of the 4th week, they were allocated into three groups of 16 chicks each. All chicks were fasted for 14 hours, then fed with a nitrogen-free diet (NFD) with 0.3% ferric oxide as a marker for 10 hours instead of 4 hours as reported by BRAGG *et al.*, because of poor consumption of the feed, and was then shifted to starter diet *(Table 2)*. Faeces with marker was collected from each individual bird. Forty eight hours later, the whole procedure was

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TABLE 1: STARTER DIET FOR AMINO ACID DIGESTIBILITY TEST

Ingredient	
Corn	54.60
Soybean meal	35.00
Fish meal	6.00
Corn oil	2.00
Vit-min premix[1]	0.35
Salt	0.25
Tricalcium phosphate	1.20
Limestone	0.50
DL-methionie (95% purity)	0.10
Total	100

1 Vit-min premix per kg diet contained vit. A palmitate 15,000 IU, Vit. D3 3,000 IU tocopheryl acetate 22.5 IU, Vit. K3 2.25 mg, thiamine 2.25 mg, riboflavin 7.5 mg, pryidoxine 3 mg, B12 15 ug, pantothenic acid 18 mg, biotin 15 ug, niacin 37.5 mg, folic acid 0.75 mg, Cu 15 mg, Mn 78.75 mg, Zn 90 mg, Fe 150 mg, I 2.3 mg, and Co 0.375 mg.

TABLE 2: NITROGEN-FREE DIET AND TEST DIETS

Ingredients	NFD	Test diets		
		PKC	POS	'Prolima'
POS	—	—	93.00	—
PKC	—	93.00	—	—
'Prolima'	—	—	—	93.00
Corn strach	90.00	—	—	—
Cellulose	3.00	—	—	—
Corn oil	6.00a	6.00	6.00	6.00
Vitamin premix[1]	0.25	0.25	0.25	0.25
Trace min. premix	0.25	0.25	0.25	0.25
Choline chloride, 50%	0.20	0.20	0.20	0.20
Ferric oxide	0.30	0.30	0.30	0.30

1 Vitamin premix per kg diet contained vitamin A palmitate 10,000 IU, D3 2,000 IU, tocopheryl acetete 15IU, riboflavin 5.5 mg, pantothenic acid 14 mg, niacin 40 mg, B12 13 ug, pyridoxine 4 mg, folic acid 1mg biotin 0.2 mg.

Trace mineral premix per kg diet contained Fe 49.7 mg, Mn 67.3 mg, Mg, 5.7 mg, Cu 11.2 mg, Zn 28.1 mg, Co 2.3 mg, and I 1.2 mg.

repeatedfor PKC, POS and 'Prolima' diets containing 0.3% marker. Each diet was assigned to 16 individual caged birds. Faeces was collected again as for NFD. In each faeces collection, the faeces was dried immediately in force-draft oven at 70°C for 18 hours. The dried faeces samples were weighed for the quantity of excretion. One

representative sample of PKC, POS and 'Prolima', 3 faecal samples from NFD, PKC, 'Prolima' diets, and one faecal sample of POS diet were analyzed for amino acid content. Faecal sample from POS-based diet was prepared by pooling the faeces from 16 birds. With the results of the amino acid analysis, the digestibility of amino acid of these three ingredients was calculated with the correction for metabolic nitrogen excreted by the NFD birds. The computation procedure for amino acid (AA) availability is as in the following formula:

$$\% \text{ AA availability} = \frac{\text{Total AA consumed} - (\text{Total AA of protein faeces} - \text{Total AA of non-protein faeces})}{\text{Total AA consumed}} \times 100$$

RESULTS AND DISCUSSION

The amino acid composition of PKC, POS and 'Prolima' is shown in *Table 3*. POS had the lowest value of lysine while the 'Prolima' had the highest. 'Prolima' was also higher in sulphur-containing amino acids, methionine and cystine, than POS and PKC.

TABLE 3: AMINO ACID PROFILE OF PKC, POS AND 'PROLIMA' AS COMPARED TO RICE BRAN, WHEAT MIDDLINGS AND SOYBEAN MEAL

Amino acid	% Dry matter					
	PKC	POS	'Prolima'	Rice bran[1]	Wheat middlings[1]	Soybean meal[1]
Protein (N x 6.25)	16.06	13.32	45.63	14.18	18.18	49.44
Alanine	0.92	0.76	2.95	--	--	--
Arginine	2.18	0.46	2.23	0.98	1.31	3.69
Aspartic acid	1.55	1.13	3.46	--	--	--
Cystine[2]	0.20	0.13	0.39	0.11	0.36	0.78
Glutamic acid	3.15	1.39	5.15	--	--	--
Glycine	0.83	0.66	2.03	0.88	0.71	2.57
Histidine	0.29	0.42	2.09	0.36	0.42	1.29
Isoleucine	0.62	0.57	1.77	0.57	0.66	2.69
Leucine	1.11	0.95	2.82	0.99	1.22	3.96
Lysine	0.59	0.38	2.53	0.65	0.78	3.29
Methionine	0.30	0.19	0.65	0.22	0.24	0.73
Phenylalanine	0.73	0.59	1.68	0.73	0.73	2.55
Proline	0.63	0.48	1.64	--	--	--
Serine	0.69	0.58	1.93	0.35	0.85	2.75
Threonine	0.55	0.55	1.98	0.53	0.56	2.03
Trytophan[3]	0.17	0.29	0.28	0.16	0.23	0.70
Tryosine	0.38	0.43	1.31	0.75	0.51	1.44
Valine	0.93	0.79	2.91	0.82	0.18	2.34

[1]Values based on NRC (1971)

[2]Tryptohan was analyzed colorimetrically with dimethylaminosinnimaldehyde after pronase hydrolysis.

[3]Cystine were analyzed as cysteine after oxidation of the sample with performic acid and hydrolysis.

'Prolima' and PKC were particularly high in arginine and glutamic acid than those of POS. The values of amino acids in PKC and POS seemed to be comparable to some common feedstuffs such as rice bran and other cereal by-products. The amino acids of 'Prolima' were close to soybean meal. However, its lysine content was slightly inferior to soybean meal but superior to peanut meal. Its sulphur amino acid levels were also slightly lower than both of these two oil meals.

The percentage amino acid availability of PKC, POS and 'Prolima' as determined by the difference of intake and excretion and corrected for metabolic and endogenous excretion from NFD birds were shown in *Table 4*. The percent amino acid availability of PKC ranged from 25.8% for glycine to 87.0% for arginine with an overall mean of 64.4%. Availability of amino acids in 'Prolima' ranged from 52.7% for glycine to 82.5% for arginine with an overall mean of 71.0%. The availability of amino acids in POS was very poor, ranging from 8.3% for lysine to 49.9% for glycine with a mean of 24.8%. When these ingredients were used in practical diets at a lower level, their digestibility might be improved, since the level of fibrous ingredients in diets play an important role in lowering the digestibility of dietary nutrients. The value of amino acid digestibility of PKC in this trial is lower than that reported by NWOKOLO *et al.*, (1976). The reason for the difference is not clear. Since

TABLE 4: DIGESTIBILITY OF AMINO ACIDS IN PKC, POS AND 'PROLIMA'

Amino acid	% Digestibility		
	PKC[1]	POS[2]	'Prolima'[1]
Alanine	67.7±2.2	29.3	53.4±0.6
Arginine	87.0±0.5	21.1	82.5±1.0
Aspartic acid	64.4±1.4	24.3	70.9±0.4
Glutamic acid	74.4±1.6	26.7	75.0±0.6
Glycine	25.8±13.4	49.9	52.7±6.7
Histidine	66.8±3.5	18.5	75.6±0.9
Isoleucine	64.9±2.7	24.1	74.3±0.7
Leucine	66.7±2.0	26.4	72.8±0.6
Lysine	58.6±2.1	8.3	80.0±0.6
Methionine	72.1±2.9	22.1	76.1±1.8
Phenylalanine	70.4±2.1	26.6	69.7±1.5
Proline	55.0±0.7	81.3	72.4±1.2
Serine	65.0±2.7	19.5	66.7±0.2
Threonine	60.7±2.1	22.8	70.3±0.4
Tyrosine	65.7±2.9	16.6	71.5±0.4
Valine	62.8±2.1	28.1	71.7±2.6
Mean	64.4±12.6	24.8	71.0±4.6

1Means of 3 birds (± SD)
2Means of duplicate tests from a pooled sample of 16 birds.

the 'Prolima' has a high value of amino acid digestibility, it is suitable to be used as a protein source replacing soybean meal and peanut meal in poultry diets.

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SUMMARY

The amino acid contents and their availability in palm kernel cake (PKC), palm oil sludge (POS) and 'Prolima' (sludge fermented product) in chicken feeding were examined. It was observed that the amino acid content of PKC and POS were somewhat close to cereal by-products and that of 'Prolima' was between soybean meal and peanut meal. The overall percent amino acid availability for PKC, POS and 'Prolima' were 74.4, 24.8 and 71.0% respectively. The possible utilization of these ingredients in chicken diets pertinent to the amino acid availability were discussed.

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