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African and Mbocayá palm meals as substitutes för sesame oil meal in baby chick rations*

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COMPENDIO

En el presente artículo se exponen datos experimentales sobre el valor nutritivo de alimentos de origen latinoamericano para uso en la alimentación de aves. Se utilizaron tortas de palma africana y mbocayá individualmente y en combinación con la de ajonjolí, en dietas vegetales para pollos, basadas principalmente en torta de semilla de algodón. Los resultados indican que la torta de palma africana es inferior, mientras que la palma mbocayá es superior al producto derivado del ajonjolí, para suplementar a la torta de semilla de algodón en dietas para pollos. — Los autores.

PALM trees in the American tropics provide a potential source of quality protein for poultry. Squibb and Wyld (8) have shown that corozo palm oil meal (*Orbignya cohune*), when fed to supply not more than 10% of the protein of baby chick rations, produces better growth than the equivalent in protein supplied by cottonseed or sesame oil meals. Squibb and Salazar (7) compared 30% corozo and 15% sesame oil meals added to a ground corn ration for swine and found that growth was the same with both meals. Feed utilization, however, was slightly better with the corozo meal. It was also reported that the meals did not complement each other.

In recent years, large scale plantings of the African palm (*Elaeis guineensis*) in Central American areas have made available increased quantities of palm oil meal (6). There are no data available, however, on the value of this by-product in poultry rations compounded of Central American feedstuffs. Another palm of the genus *Acrocomia* grows in abundance from Central Mexico to Northern Argentina. One species of this genus, the mbocayá palm (*Acrocomia totai*), is of economic importante to Paraguay, where the fruit is eaten by both man and animals (1, 3, 4). No information is available, however, on the nutritional value of the pulp meal by-product for poultry.

This study continues the series on the nutritional value of feedstuffs of the American tropics. African and mbocayá palm oil meals were fed singly and in combination with sesame oil meal as supplements to cotton seed oil meal in simplified all-vegetable protein rations for baby chicks.

Materials and Methods

Straight-run, three-day old, New Hampshire chicks were stratified by weight and distributed at random among the experimental groups. The chicks were housed in all-wire cages with heat thermostatically controlled at the appropriate temperature for the age of the chicks. Feed and water were offered *ad libitum* and the chicks were weighed individually each week over 35-day test periods.

The proximate analysis data on the oil meals studied are presented in table I. These show the African oil meal to be similar and the mbocayá oil meal higher in protein content than corozo oil meal, which was used as a reference palm oil meal. All three palm meals are lower in protein and higher in fiber than either sesame or cottonseed oil meal. Of the three palm meals, mbocayá is the lowest in crude fiber content.

The amino acid content of the major protein sources in the experimental rations are given in table II, including the chick amino acid requirement as per cent of diet (2). The amino acid composition of sesame and cottonseed oil meals were taken from Orr and Watt (5). In general, the palm oil meals are lower in mg. of methionine and cystine per gram of nitrogen than sesame oil meal. Of the three palm oil meals, mbocayá appears to have a little more favorable amino acid content per gram of nitrogen in relation to the requirements of the chick.

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Table I.—Percentage chemical composition of oil meals.

Ingredient	H_2O G.	Crude protein G.	NFE G.	FAT G.	Crude fiber G.	Ash G.	Ca Mg.	P Mg.	Fe Mg.
Mbocayá palm pulp meal	8.6	28.2	29.1	13.1	15.2	5.8	313	1050	27.5
African palm oil meal	5.4	20.2	36.4	10.2	22.9	4.9	195	692	19.3
Corozo palm oil meal *	8.2	19.8	35.6	7.2	21.8	4.3	200	189	——
Sesame oil meal	5.8	35.5	32.9	16.5	4.4	9.8	2176	1051	73.0
Cottonseed oil meal	8.1	38.8	30.8	16.1	4.8	6.2	279	1022	10.2

* Squibb and Wyld, 1952.

Table II — Comparison of the essential amino acid content of oil meals.

Amino acid	African Palm*		Corozo		Mbocayá		Sesame***		Cottonseed***		Amino acid**** chick requirement % of diet
	G.%	G./G.N.**	G.%	G./G.N.	G.%	G./G.N.	G.%	G./G.N.	G.%	G./G.N.	
Arginine	1.45	0.66	1.64	0.47	5.21	1.12	3.19	0.60	5.64	0.83	1.2
Histidine	0.47	0.21	0.98	0.28	1.38	0.30	0.59	0.11	1.32	0.20	0.3
Isoleucine	0.68	0.31	0.79	0.23	1.53	0.33	1.89	0.35	1.88	0.28	0.6
Leucine	0.87	0.40	1.10	0.31	1.84	0.40	3.15	0.59	2.94	0.43	1.4
Lysine	0.73	0.33	1.03	0.29	1.77	0.38	1.00	0.19	2.15	0.32	0.9
Methionine	0.48	0.22	0.51	0.15	0.07	0.02	1.14	0.21	0.70	0.10	0.5
Cystine	0.11	0.05	0.22	0.06	0.35	0.08	0.86	0.16	0.80	0.12	
Phenylalanine	0.54	0.25	0.96	0.27	1.02	0.22	2.90	0.54	2.59	0.38	0.9
Tyrosine	0.27	0.12	0.35	0.10	0.73	0.16	1.54	0.29	1.31	0.23	
Tryptophan	0.09	0.04	0.14	0.04	0.27	0.06	0.59	0.11	0.59	0.09	0.2
Valine	0.75	0.34	1.04	0.30	1.54	0.33	1.36	0.25	2.46	0.36	0.8
% Nitrogen	2.20	——	3.50	——	4.65	——	5.34	——	6.77	——	3.2

* The sample analyzed was not the same as the one for which data are given in Table I.

** Grams of amino acid per gram of nitrogen.

*** Orr and Watt (1955).

**** Block (1956).

Table III.—Composition of the ration and the growth and efficiency of feed utilization of New Hampshire chicks fed African and mbocayá palm meals.

Ingredients	Experiment 1						Experiment 2				Experiment 3			Experiment 4			
Group	1	2	3	4	5	6	1	2	3	4	1	2	3	1	2	3	4
Mbocayá pulp meal*	—	—	—	—	—	—	—	—	—	—	40	60	80	—	7	14	21
African palm meal**	20	30	40	50	60	70	—	12	24	36	—	—	—	—	—	—	—
Fish meal	5	5	5	5	5	5	—	—	—	—	5	5	5	—	—	—	—
Sesame oil meal	—	—	—	—	—	—	15	10	5	—	—	—	—	15	10	5	—
Cottonseed oil meal	—	—	—	—	—	—	25	25	25	25	—	—	—	25	25	25	25
Ramie meal	10	10	10	10	10	10	—	—	—	—	10	10	10	—	—	—	—
Ground sorghum	61	51	41	31	21	11	56	49	42	35	41	21	1	56	54	52	50
Mineral mixture***	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Cod liver oil°	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Antibiotics°°	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
B complex°°°																	
Crude protein %	13.8	14.9	16.0	17.1	18.2	19.3	20.5	20.5	20.5	20.5	20.3	24.7	29.1	19.2	19.2	19.2	19.2
Number of chicks	12	12	12	12	12	12	24	24	24	24	12	12	12	12	12	12	12
Av. weight-start, Gm.	49	49	49	49	49	49	50	50	50	50	38	38	38	38	38	38	38
-end, Gm.	180	220	203	230	194	190	302	308	286	279	286	258	251	272	333	418	474
Effic. feed utilization	—	—	—	—	—	—	2.26	2.39	2.60	2.93	2.62	2.78	2.97	2.49	2.43	2.19	2.12
	Quadratic component significant						Linear component significant				Linear component highly significant			Linear component highly significant			

* Obtained from Asunción, Paraguay, courtesy of Mr. R. C. Lorenz.

** Obtained from the United Fruit Company, Honduras.

*** Calcium carbonate, 1; salt, 1; bone meal, 1; and minor elements.

° 1800 I.U's vitamin A per gram.

°° Aurofac, courtesy of Dr. T. H. Jukes and Lederle Laboratories.

°°° Thiamine chloride, 0.2 Mg.; pyridoxine, 0.35 Mg.; calcium pantothenate, 1.2 Mg.; niacin, 1.5 Mg.; riboflavin, 0.35 Mg.; choline chloride, 125.0 Mg.

Results

Feeding experiments with African palm oil meal. — In order to establish tolerance levels and any possible toxicity of the African palm oil meal, it was first fed in combination with fish meal (experiment 1) at 6 levels, ranging from 20 to 70%, replacing the ground sorghum of the reference diet. In experiment 2, the African palm oil meal was compared with sesame oil meal at 4 levels as a supplemental protein in rations containing cottonseed oil meal as the principal protein source.

The rations fed, the resulting growth and efficiency of feed utilization of the baby chicks of each of the experiments are presented in table III. Under the conditions of experiment 1, the substition of increasing amounts of African palm meal for the ground sorghum resulted in an improvement in the growth of chicks, coincident with the increasing protein content of the ration, up to 50% of this meal. At levels of 60 and 70%, the beneficial effect of the increased protein appeared to be more than offset by the excessive amount of crude fiber. In experiment 2, in which the African palm meal was substituted isonitrogenously for sesame oil meal and ground sorghum, 12% was more effective than 24 or 36% in terms of both growth and feed efficiency.

Feeding experiments with mbocayá pulp meal. — Only a limited quantity of this pulp meal was available, so the estimate of the tolerance level and possible toxicity was made by feeding it at 40, 60 and 80% of the ration in combination with fish meal (experiment 3). In experiment 4, the mbocayá pulp meal was compared with sesame oil meal as a supplement to cottonseed oil meal. In this experiment the meal was fed at 7, 14 and 21% of the basal diet, replacing the equivalent in protein of the sesame oil meal and ground sorghum.

These data of table III show that when the mbocayá pulp meal was fed at a level greater than 40% of the diet the growth of the chicks was depressed. Further, it was apparent that the pulp meal was superior to sesame oil meal as a supplement to cottonseed oil meal.

Discussion

These studies are a continuation of the biological evaluation of feedstuffs of tropical America. They indicate that African and mbocayá palm oil meals may be added to the growing list of vegetable protein feedstuffs for use in poultry feeding in these areas.

As in the case of corozo oil meal (8), African palm meal should not be fed in excess of 50% and mbocayá meal 40% of the diet since a depression in growth and a lowered efficiency of feed utilization may occur, due to excessive crude fiber or to unknown factors.

The high growth rate of the chicks and the amino acid content of the meal, as determined by biological assay, confirm the excellent quality of the mbocayá protein. It is evident that exploitation of species of this genus (*Acrocomia*) would aid in alleviating the scarcity of protein feedstuffs in areas of the American tropics and would also provide other cash crops for export.

Summary

African palm oil meal (*Elaeis guineensis*) was inferior and mbocayá pulp meal (*Acrocomia totai*) superior to sesame oil meal as a supplement to cottonseed oil meal in simplified all-vegetable protein rations for baby chicks. These meals may be fed to constitute as much as 40% of the ration without decreasing the efficiency of feed utilization or depressing the growth of New Hampshire chicks.

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