EFFECT OF PROCESSING ON NUTRITIVE VALUE OF CASSAVA MEAL FOR BROILER CHICKS

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ABSTRACT

Three graded levels (15, 30 and 45%) of each of cassava flours, peeled cassava meal (PCM), unpeeled cassava meal (UCM) and garri were fed to Ross — type broiler chicks from one to six weeks of age and thereafter treatment groups were fed a common finisher ration to 10 weeks of age. All substitutions were made at the expense of maize and each treatment diet contained 24% crude protein. At six weeks of age the result showed that cassava meals could substitute the maize component up to 45% without adverse effect on the final live-weight, feed consumption and feed efficiency. Also different processing methods applied to the cassava tubers did not affect the performance of birds. At 10 weeks of age only the birds on garri showed slight but significant differences relative to other dietary treatments.

INTRODUCTION

One of the most important factors affecting the improvement in livestock production is the availability of cheap and good quality feedstuffs. As population increases faster than food production, expansion of existing methods of producing plant and animal protein will not meet the growing needs.

In Nigeria, one of the major problems confronted by the poultry industry is the shortage of local feeds. The existing practice of heavy dependence on imported feed ingredients will continue to pose a constraint to the development of the livestock industry. One local source that could partially remedy this shortage is cassave *(Manihot esculenta, Crantz).* Cassava is of great importance in the national economy of Nigeria and is second only to yam in total root production. Umanah (1976) projected that by 1985, Nigeria would be producing 13.9 million metric tons of cassava annually. Although the carbohydrate production exceeds that of other crops, early findings have shown that cassava root meal is not satisfactory replacement for maize in broiler chicks. Vogt (1976) for example reported that growth depression was observed when 20 or 30% cassava meal was fed to broilers. Oslon *et al* (1969) incorporated peeled cassava root meal in broilers (7.5 to 45.0%). They found that cassava flour could be added into diets for chicks at levels up to 30% without affecting weight increases if the feed was balanced for energy and protein. Armas and Chicco (1973) replaced corn with cassava flour in broiler diets. They found no significant differences with respect to weight gain and feed efficiency up to 36 replacement. When the diet contained 54% cassava flour, weight gain was reduced by 8.1%. According to Sebastia *et al* (1973), feed consumption was not affected in broilers by substitution up to 50% of sorghum by cassava meal. They, however, found significant differences in weight gain, the best diet being that in which 30% of sorghum was substituted by cassava root flour. Higher levels gave rise to marked deterioration in weight gain and feed efficiency. On the other hand Tejada and Brambila (1969) and Obioha (1975) have shown that cassava meal and gari respectively could be fed to broiler chicks up to 50% without adverse effect on growth rate and feed efficiency. And more recently Pido *et al* (1979) studied the effect of graded levels of fermented cassava meal on broilers. These authorsfound that 50% incorporation produced no significant differences in the parameters measured. Their results indicate that it is economical to include cassava meal up to 50% of broiler rations.

The contradictory results so far reported when cassava meal replaces grain in poultry rations can be explained partially by different methods of preparation of the meals used in the trials. The present paper describes feeding trials carried out in this laboratory to assess the effect of processing on energy value of cassava meals as judged by broiler chick assay.

MATERIALS AND METHODS

Preparation of cassava meals:

All the samples of cassava variety used in this experiment were prepared and supplied by the National Root Crop Research Institute, Umudike, Briefly, the samples were prepared as follows:

Garri. The cassava tubers were peeled and grated. A small of oil was added to the grated material and properly mixed. The material was loaded into a jute bag and the end tied. Water was squeezed out by placing the bag between four sticks, two below and two above. The lower and upper sticks were tied tightly with ropes and this was retied at intervals of 3 hours. Reasonable dehydration was achieved within 15 hours. After the removal of water, the bag content was emptied on a cemented floor and spread thinly for sun drying. The dried material was sieved to remove the fibrous inner core. The sample was then fried with oil by a low temperature process called garifying.

Peeled cassava meal (PCM). The cassava tubers were peeled, grated and loaded in a jute bag. It was allowed to ferment for 19 hours and thereafter water was squeezed out as described for garri but the process was completed within 6 hours. This was followed by sun drying for six days.

Unpeeled cassava meal (UCM). The unpeeled cassava tubers were washed, grated and loaded in a jute bag. Water was squeezed out as described earlier. But this lasted for two days. Removal of water was followed by sun drying for six days.

All the samples were bagged and stored until required for compounding rations (Table 1A). Table 1B shows the proximate chemical composition of all the cassava meal samples used for the feeding trials.

TABLE 4A

Composition of the Experimental ratting (on Oven dry basis)

O Ingredients	*O (%)*	*P.C.M. (%)*			*U.C.M. (%)*			*Garri (%)*		
Cassava meal	—	15	30	45	15	30	45	15	30	45
Yellow malse	65.0	47	29	11	46	28	10	47	29	11
Groundnut cake ..	25.0	28	51	34	29	32	35	28	31	34
Fish meal	5.0	5	5	5	5	5	5	5	5	5
Meat and bone meal..	3.0	3	3	3	3	3	3	3	3	3
Pariwninke shell ..	1.0	1	1	1	1	1	1	1	1	1
Premix*	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Lys	0.10	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Met	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Calculated crude protein (%)	24.08	23.98	24.09	24.19	24.22	24.27	24.13	23.95	24.03	24.10
Determined crude protein (%)	23.96	23.94	24.06	24.02	24.10	24.76	24.05	23.94	24.01	23.95

*A Pfizer Livestock Feeds products supplying the following nutrients per kg of ration: Vit. A 9820.8 I.U. Vit. D 1636.3 ICU; Riboflavin 45mg; Pantothenic acid 8.18mg; Nicotinic acid, 20.45mg; Folic acid 0.82mg; choline chloride 122.72mg; Vit. F 4.09 units; Vit. K 1.83mg; Vit. B12 0.008mg; Met. 204.5mg; Cobalt 1.02mg; Iodine 0.82mg; Cu 8.18mg; Mn 45.8mg; Zn 40.9mg; Iron 16.36mg.

TABLE 1B

Proximate Chemical composition of the cassava samples used (%)*

	Dry matter	*Crude Protein*	*Crude Fibre*	*Ether extract*	*Ash*	*NFE*	*Ca*	*P*	*Cu (mg/kg)*	*Zn (mg/kg)*	*mg (mg/kg)*
Peeled cassava meal	86.5	2.00	0.58	0.65	0.81	82.46	1.04	0.4	5.1	4.1	18.2
Unpelled cassava meal	86.8	2.30	1.20*	0.58	1.20	81.52	1.38	0.4	5.4	4.0	14.0
Garri	89.6	1.80	0.59	1.10	0.63	85.48	0.89	0.4	6.0	4.1	15.5

* = Values on oven dry basis.

Broiler starter experiment. The experiment was conducted with Ross — type broiler chicks. After an adjustment period of one week, some 1000 chicks were randomly assigned into 10 treatments of 100 chicks each on the basis of body weight and weight distribution among the groups. Each experimental diet was fed to duplicate floor pens of chicks from 1—6 weeks of age. The composition of the experimental diets is shown in Table 1A. All treatment diets contained 24% of crude protein but no attempt was made to equalise the energy levels. All the diets were supplemented with 0.3% methionine as suggested by Ross and Enriquez (1967). Water and feed were provided free choice throughout the feeding period. A weekly record of feed consumption was kept and birds were weighed in groups every week.

Broiler finisher experiment. The plan and conduct of the experiment were similar to those described for the broiler starter experiment. All treatment groups were fed a common finisher ration. The objective was to find out whether any observable differences in the treatments could be reversed by feeding a high quality finisher feed. The feeding lasted from 6 to 10 weeks of age.

At the end of 10—week period the data collected were subjected to variance analysis and least significant (LSD) analysis as outlined by Steel and Torrie (1960).

RESULTS AND DISCUSSION

The average live weight, feed consumption and feed efficiency (g feed eaten/g weight gain) at 2,3,4,5 and 10 weeks of age are summarised in Tables 2,3 and 4 respectively. The data show that broiler compared with chicks previously used in this laboratory. The problem was identi-

TABLE 2

Average body weight (g) at weekly intervals of broiler chicks fed different Levels of cassava meals Diets

Weeks	0	PCM 15%	PCM 30%	PCM 45%	UCM 15%	UCM 30%	UCM 45%	Garri 15%	Garri 30%	Garri 45%	LSD**
2	156.7	152.7	152.1	153.6	155.6	158.1	157.8	155.7	150.7	159.1 ± 1.52*	6.14
3	252.5	254.5	257.6	253.5	254.1	262.8	254.0	254.7	254.1	257.4 ± 3.08	12.47
4	399.9	425.6	399.1	405.5	399.8	413.0	402.5	405.6	417.0	429.9 ± 8.6	25.8
5	596.6	608.2	628.8	629.1	599.3	615.8	589.9	599.2	633.1	636.2 ± 7.25	21.5
6	842.6	832.4	865.3	863.1	828.7	882.3	812.3	813.8	813.8	882.5 ± 20.28	48.8
10	1578.2	1588.0	1540.6	1562.6	1535.9	1524.2	1476.8	1496.6	1443.5	1461.8 ± 30.21	89.4

*Values with their standard errors
**P (0.05)

TABLE 3

Average feed consumption (g) at weekly intervals of broiler chicks feed different level of cassava meals

Weeks	0	PCM 15%	PCM 30%	PCM 45%	UCM 15%	UCM 30%	UCM 45%	Garri 15%	Garri 30%	Garri 45%	LSD
+	95.2	101.3	104.2	93.7	98.8	97.5	96.5	100.2	100.2	99 ± 4.19*	12.39**
3	181.8	188.7	191.8	192.6	185.2	191.0	192.1	192.8	185.5	180.4 ± 3.5	10.67**
4	515.8	540.8	541.1	543.2	529.2	556.6	562.6	547.9	504.7	503.7 ± 11.15	45.09***
5	952.4	1000.2	1006.4	1008.4	987.6	1028.0	1024.7	962.0	948.5	931.8 ± 21.17	64.30**
6	1442.4	1503.5	1539.2	1559.5	1503.1	1520.3	1558.8	1476.7	1444.6	1417.9 ± 50.3	48.8**
10	4003.4	3986.3	4048.0	4132.8	3916.9	4005.6	4067.5	4063.9	3846.8	3806.9 ± 90.98	269.3**

* = Values with their standard errors.
** = P (0.05).
*** = P (0.01).

TABLE 4

Average feed/gain ratio of weekly intervals of broiler chicks fed different levels of cassava meals

Weeks	0	PCM 15	PCM 30	PCM 45	UCM 15	UCM 30	UCM 45	Garri 15	Garri 30	Garri 45	LSD
2	1.40	1.55	1.53	1.58	1.58	1.63	1.65	1.50	1.55	1.58 ± 0.04*	0.105**
3	1.78	1.78	1.85	1.94	1.85	1.86	2.02	1.89	1.87	1.89 ± 0.052	0.21***
4	2.05	2.35	2.38	2.45	2.45	2.51	2.40	2.17	2.19	2.00 ± 0.156	0.327**
5	2.12	2.47	2.50	2.65	2.56	2.65	2.72	2.29	2.40	2.41 ± 0.047	0.189***
6	2.28	2.55	2.67	2.66	2.68	2.71	2.90	2.34	2.43	2.45 ± 0.04	0.163
10	2.80	2.86	2.88	2.94	2.81	3.20	3.29	3.08	2.90	2.82 ± 0.149	0.44

* = Values with their standard errors.
** = P (0.05).
*** = P (0.01).

fied to lie with the batch of the Ross breed used since the composition of the control diet had always been the same. Because of this the total live-weight attained in this experiment (including those in the control diet) was inferior to those reported by Pido *et al* (1969). Similar observations were made by Babatunde and Fetuga (1976) in which 410.5 to 1839.9g were recorded at 10—weeks of age. The effect of increasing graded levels of cassava caused slight but significant differences ($P \leq 0.05$) on total liveweight, feed consumption and feed efficiency among dietary treatments. This is in agreement with works of Enriquez and Ross (1967), Olson *et al* (1969a) and Pido *et al* (1979). Khajarern and Khajarern (1967) noted in their first experiment statistically significant differences for weight gain and dietary efficiency during 1—5 weeks of age and concluded that the ability of broilers to utilize cassava meal increased with age. Our results did not support this view point. Chicks on all the dietary treatments grew well throughout the 1—6 weeks feeding period. Lack of agreement may be due to the differences in the method of preparation of the meals used. Khajarern and Khajarern (1976) used milled cassava chips which were not fermented whereas the meals used in the present study underwent some degree of fermentation and it has been demonstrated (Akinrele, 1964) that fermentation induced detoxification of cassava roots.

Average body weight of chicks on garri at 10 weeks of age was low relative to those on PCM and UCM. This is contradiction with good performance of broiler chicks fed graded level of garri up to 50% of maize in the ration as reported by Obioha (1975). The body weight of chicks on UCM was excellent and compares favourably with those on control and PCM.

Feed consumption was good for all dietary treatments relative to the control. However, the lowest feed consumption was recorded for chicks on graded levels of garri. This may be due to higher energy levels in garri diets. Garri was fried with palm oil. The data (Table 3) also showed that replacing maize with 45% cassava meals caused significantly higher feed consumption ($P \leq 0.01$) by chicks on PCM and UCM. In general, feed consumption increased with age. This is in accord with the findings of Obiola (1975).

Poorer feed efficiency was noted for PCM and UCM meals relative to other dietary treatments. The dry texture and flavour could have contributed to the higher intake of the two fermented cassava meal diets. Another possibility is that the diet containing the cassava meals except garri, contained lower metabolizable energy (ME) since maize has higher ME than cassava flour. Thus, the chicks on PCM and UCM would have consumed more feed to meet their energy requirements.

Only eleven birds died during the starter feeding period and this could not be related to any dietary effect judging from the results obtained from the chemical analysis of the cassava meals and the performance of the broilers, it can be concluded that the three types of the cassava meals compared favourably to maize substitution up to 45%. It could probably be used to replace the entire maize component of the diet when properly supplemented with other nutrients particularly methionine.

In conclusion, the literature shows no general agreement on cassava root meal as dietary energy source for chicks. This is because the cassava root meal with which research on chick nutrition has been carried out has not been uniform either in composition or in the method of preparation. It is therefore suggested that researchers should provide information regarding the processing procedure and composition of the cassava meals used in their experimentation to enable valid comparisons to be made from different localities. The experiment herein reported shows that unpeeled cassava and peeled cassava root tubers are two nutritionally valuable products that can be obtained from cassava plant per poultry feeds. Use of cassava meals in poultry rations will materially give a boost to poultry production in this country.

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REFERENCES

AKINRELE, I.A. 1964. Fermentation of cassava. J. Sci. Food Agri. **15**; 589—594.

ARMAS, A.B. and CHICCO, C.F. 1973. Cited by Montilla J.J. 1977. Cassava in the nutrition of broilers. In "Cassava as Animal Feed" Editors: Barry Nestel and Michael Grahan, IDRC University of Guelph, 1977.

BABATUNDE, G.M. and FETUGA, B.L. 1976. Determination of minimum crude protein requirements of broiler starters and finishers in the tropics. Nig. J. Anim. Prod: **3(1)**; 126—138.

ENRINQUEX, F.Q. and ROSS, E. 1967. The value of cassava root meal for chicks. Poult. Sci. **46**; 622—626.

KHAJARERN, S. and KHAJARERN J.M. 1976. Evaluation de la harina de yuca *(Manihot esculenta)* en raciones para pollos de engorde. Agron. Trop. (Maracay), **23(6)**; 593—599.

PIDO, P.P., ADEYANJU, S.A. and ADEGBOLA, A.A. 1979. The effect of graded levels of fermented cassava on broilers. Poult. Sci. **58**; 427—431.

OBIOHA, F.C. 1975. The grain replacement value of processed cassava in broiler finisher rations. Nig. J. Anim. Prod. **2**; 277—289.

OSLON, D.W., SUNDE, M.L. and BIRD, H.R. 1969. Amino acid supplementation of mandioca meal chick diet. Poult. Sci. **48**; 1949—1953.

SABASTIA, J.M., LOPEZ, J., MARTINS, E.S., OLIVERIRA, M.M. and COLLARES A. 1973. Cassava meal as a part substitute for maize in the feeding of fattening chickens. Nutr. Abstr. Rev. **45**; 648.

STEEL, R.G.D. and TORRIE, J.H. 1960. Principles and procedures of statistics, McGraw-Hill, New York.

TEJADA, H. and BRAMBILA, S. 1969. Investigations of nutritional value of cassava for the growing chick. Tecnia Pecuraria en Mexico. **3**; 329.

UMANAH, E.E. 1976. Cassava research in Nigeria before 1972. In proceedings of Fourth Symposium of the International Society for Tropical Root Crops, Colombia in August 1976. Editors James Cook, Reginald McIntyre and Michael Graham, IRDC, University of Guelph.

VOGT, H. 1966. The use of tapicca meal in poultry rations. Wld. Poult. Sci. **22**; 113—125.