CASSAVA ROOT MEAL AS POULTRY FEED.
2 -EFFECT OF REPLACING YELLOW CORN WITH GRADED LEVELS OF CASSAVA ROOT MEAL ON BROILER PERFORMANCE.

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A study was conducted to investigate the level at which cassava root meal (CRM) could replace yellow corn (YC) in broiler diets without deleterious effect on performance.

The first experiment included twelve metabolism trials to evaluate the twelve experimental diets used in experiment 2. Three adult cocks were used in each trial. The results showed that each set of rations (starter, grower and finisher) was similar in the feeding value and C/P ratio and any difference in chick performance would be attributable to the differences in the feeding qualities of CRM presented in the experimental rations at the tested levels.

The second experiment was undertaken to study the effect of replacing YC with CRM in broiler diets on chick performance. The substitution was made gradually at levels of 0, 20, 40 and 60% of YC in each set of starter, grower and finisher diets. Each set of the twelve experimental diets was isonitrogenous and isocaloric and supplemented with the required vitamins and minerals. Each experimental diet was fed to 3 replicate groups of 30 chicks each. Therefore, 360 day - old Arbor Acres chicks were used.

The results obtained for broiler performance showed that the response of chicks to utilize CRM was increased with advancement of age. The feed efficiency (FE) and total protein efficiency (TPE) generally decreased with increasing level of CRM in the diet during the first 6 weeks of age, while during

the period of 6-8 weeks of age the values were significantly similar among the different diets. On the basis of weight gain, FE and TPE of birds it could be concluded that , CRM can replace YC into starter, grower and finisher diets at the levels of 0.0% , 20-40% (12-23% of diet) and 60% (37% of diet) respectively without adverse effect on performance if the diets are balanced in respect of all nutrients. However, substitution of YC during the 8-week experimental period with up to 20% CRM (12% of diet) resulted in similar performance that compared favourably with the control.

There was no significant difference in mortality rate during the different stages of life that could be ascribed to level of CRM in the diets.

Yellow corn (YC) is the most important source of energy in broiler diets, representing 60 to 70% of their composition. Annual shortage in this feed grain calls for the use of other carbohydrates as supplementary sources of energy in poultry feed. Cassava root meal (CRM) has been proposed recently as a substitute for yellow corn in Egypt.

Earlier findings have shown that CRM is a satisfactory replacement for corn in chicks (Enriquez and Ross 1967; Olson et al., 1969 b ; Müller et al., 1971 ; Chou and Müller ,1972 and Hutagalung et al., 1973). Müller and Chou (1971) reported that there were no significant differences in growth rate , feed consumption, feed per gain ratios and mortality rate for chicks receiving 0, 20, 30, 40, 50 and 58% cassava pellets . Hutagalung et al. (1973) found similar results to those of Müller and Chou (1971) when they fed broiler diets containing 0, 20 and 40% CRM.

This study was carried out to investigate the level at which local cultivated CRM could replace YC in broiler diets without adverse effect on performance.

MATERIAL AND METHODS

The same batches of cassava root meal (CRM) and yellow corn (YC) used in the previous investigations (El-Sherbiny et al., 1986) were used in this study. Soybean meal, (SBM), fish meal (FM), bone meal (BM), limestone, yeast and vitamin-mineral premix were purchased from the open market. All samples were finely ground to be ready for analysis or use in diets.

Experiment 1 :

Determination of nutrients digestibility, feeding value and ME of diets containing graded levels of CRM used in exp. 2: Twelve trials were conducted to evaluate the twelve experimental diets used in exp. 2. Three adult cocks (Plymouth Rock) of 36 weeks old were used in each trial. The birds were assigned randomly in metabolism cages. The preliminary period continued for 4 days followed by 3 days collection period Feed and water were offered ad-lib. The experimental techniques and calculating the feeding value were as previously described by El-Sherbiny et al. (1986).

Experiment 2 :

Effect of replacing yellow corn with graded levels of CRM on broiler performance: Three hundred and sixty day-old broiler type chicks namely Arbor Acres were obtained from El-Kahera Poultry Company.

Twelve experimental diets were formulated in which CRM replaced yellow corn with levels of 0, 20, 40 and 60% as shown in Table 1. Soybean meal was increased as necessary to keep each set of tested rations isonitrogenous. Each experimental diet was fed to 3 replicate groups of 30 chicks each. The groups were randomly allocated in electric battery brooders. Each set of the experimental diets (starter, grower and finisher) was isonitrogenous and isocaloric. The minerals and vitamins were adequately supplied to cover the requirements according to NRC (1984).

Table 1 : Composition of experimental diets.

Diets	Starter diet 1	2	3	4	Grower diet 5	6	7	8	Finisher diet 9	10	11	12
Ingredient	control	20% CRM	40% CRM	60% CRM	control	20% CRM	40% CRM	60% CRM	control	20% CRM	40% CRM	60% CRM
Cassava root meal (2.8% CP)	0.0	11.0	22.4	32.6	0.0	12.0	23.0	34.0	0.0	13.0	25.0	37.0
Yellow corn (7.9% CP)	56.0	44.0	32.0	21.0	60.0	47.0	35.2	23.2	65.3	51.0	38.0	25.0
Soybean meal (38% CP)	35.0	36.0	36.6	37.4	33.0	34.0	34.8	35.8	31.7	33.0	34.0	35.0
Fish meal (60.2% CP)	6.0	6.0	6.0	6.0	4.0	4.0	4.0	4.0	-	-	-	-
Limestone	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Bone meal	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Yeast *	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Premix	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Total	100	100	100	100	100	100	100	100	100	100	100	100
Chemical Analysis % :												
Moisture	10.04	9.58	9.80	9.76	9.90	10,10	10.08	9.81	10.01	9.76	9.88	10.00
Crude protein	22.30	21.99	21.65	21.46	20.00	19.82	19.91	19.92	17.66	17.54	17.37	17.03
Ether extract	2.02	2.01	1.76	1.72	1.50	1.51	1.42	1.37	1.00	0.99	0.98	0.89
Crude fibre	3.77	3.70	3.91	3.99	3.91	3.97	3.98	4.00	4.12	4.67	4.48	4.72
Ash	7.59	8.11	8.15	8.37	7.27	7.56	7.77	7.83	7.06	7.37	7.51	7.80
Nitrogen free extract	54.28	54.61	54.73	54.70	57.42	57.04	56.84	57.07	60.15	59.67	59.78	59.56
Determined ME Kcal/Kg	2942.5	2916.7	2879.2	2833.9	2961.3	2950.0	2889.8	2894.8	3003.5	2964.8	2921.3	2903.6
C/P ratio.	132	133	133	132	148	149	145	145	170	169	168	170

* Broiler Premix (content / Kg).
Vit A 3000,000 IU, Vit. D3 300,000 IU, Vit E 3000 mg, Vit K 300 mg, Vit B1 300 mg, Vit B2 800 mg, Nicotinic acid 5000 mg, Pantothenic acid 2000 mg, Vit.B6 700 mg, Vit B12 3000 µg, Choline chloride 40000 mg, Manganese sulphate 8000 mg, Zinc oxide 6000 mg, Ferrous sulphate 2500 mg, Copper sulphate 500 mg, Cobalt chloride 10 mg, Potassium Iodide 50 mg, Sodium selenite 10 mg, TM HCL 0.7gm , Zinc Bacitracine 3000 mg, Amprol Plus 12500 mg, Methionine 100,000 mg, Lysine 50000 mg, Carrier limestone

At the beginning of the experiment, chicks were randomly distributed into four groups of equal numbers according to the different treatments (90 birds/treatment). Birds of each treatment were sub-divided into three subgroups of equal numbers of 30 birds each. Chicks were wing banded at the first day of age, individually weighed to the nearest gram, distributed in the batteries under similar conditions. Chicks in all treatments were eye vaccinated against New-Castle disease on the fifth day of age. Diets and fresh water were offered ad-lib. Food consumption was recorded and birds were weighed at weekly intervals. Total feed consumption and total weight gain of each group were recorded at the end of the experimental period (8 weeks).

The chemical analysis of feed and excreta, faecal nitrogen and calorific value were determined as previously reported by El-Sherbiny et al., (1986).

The data were subjected to analysis of variance as described by Steel and Torrie (1980). Significant differences between treatment means were determined using Duncan's multiple range test (1955).

RESULTS AND DISCUSSION

Experiment 1 :

The feeding value and ME of diets containing graded levels of CRM used in experiment 2.

It is clear from Table 2 that the feeding value and ME of each set of rations were nearly similar. Such slight variations among the tested rations might be due to allowable experimental error and negligible variability among experimental birds. Such differences could be practically neglected.

Although the mean values of CP content of the successive sets of the experimental rations (varying in CRM levels) were the highest (24.22%) with the starter decreasing slightly with the grower (22.12%) and further decreased with the finisher

Table 2 : Feeding value and ME of the experimental rations used in Exp. 2.
(Experiment I)

Trial No.	Item.	Dietary CP%	TDN %	SV %	Determined ME Kcal /g	C/P ratio	N. [1] balance %
		Values on DM basis					
Starter rations :							
1.	0.0% CRM	24.79	60.63±0.61 [2]	59.59±0.58	2.942±0.06	119±1.45	35.30
2.	20% CRM	24.32	62.12±0.93	61.01±0.86	2.918±0.05	120±1.73	30.42
3.	40% CRM	24.00	63.54±0.12	62.17±0.10	2.879±0.06	120±2.31	22.09
4.	60% CRM	23.78	61.36±0.04	60.08±0.03	2.834±0.01	119±0.58	27.22
Mean Value		24.22	61.91±0.42	60.71±0.39	2.893±0.04	120±1.72	28.76
Grower rations:							
5.	0.0% CRM	22.20	61.06±0.46	60.53±0.45	2.961±0.03	133±0.03	21.11
6.	20% CRM	22.05	60.84±0.31	59.35±0.30	2.950±0.01	134±0.58	29.79
7.	40% CRM	22.14	63.29±0.18	61.64±0.17	2.889±0.02	131±0.88	14.68
8.	60% CRM	22.09	62.50±0.46	60.89±0.42	2.895±0.06	131±2.89	27.04
Mean Value		22.12	61.92±0.35	60.60±0.35	2.924±0.03	132±1.45	23.16
Finisher rations :							
9.	0.0% CRM	19.62	60.54±0.25	58.69±0.24	3.004±0.01	153±0.58	17.64
10.	20% CRM	19.44	60.87±0.45	59.02±0.44	2.965±0.02	152±1.45	27.99
11.	40% CRM	19.27	62.89±0.55	60.88±0.52	2.921±0.06	152±3.18	18.26
12.	60% CRM	18.92	62.49±0.67	60.43±0.64	2.904±0.05	153±2.06	26.46
Mean Value		19.31	61.70±0.48	59.76±0.46	2.948±0.04	152±1.82	22.59

1. AS % from total N intake.
2. SE : Standard error.

(19.31%) diets, yet their corresponding feeding values as determined ME were nearly similar being 2.893, 2.924 and 2.948 Kcal/g diet. This was reflected on the corresponding C/P ratios being 120, 132 and 152. Such ratios are in general agreement with the common levels used in broiler rations in Egypt during the successive growth periods.

The value of N-balance as a percentage of N-intake indicated that the N-balance was positive in all tested rations ranging from 14.68% to 35.30% without special trend.

Therefore, each set of rations was similar in the feeding value and C/P ratios and any differences in chick performance would be attributable to the differences in the nutritional qualities of CRM presented in the experimental rations at different levels. This will be tested in details in the next experiment.

Experiment 2 :

Effect of replacing YC with graded levels of CRM in rations on broiler performance .

Average results obtained for broiler performance in terms of live body weight (BW), weight gain (WG), feed consumption (FC), feed efficiency (FE), total protein efficiency (TPE), metabolizable energy utilization (MEU), growth rate (GR) and mortality rate (MR) are summarized in Tables 3 and 4.

As shown in Table 3, the initial live weight of day-old chicks for all treatments was very similar ranging from 37.1 to 38.3 g. The average live weight of 0.0% CRM treatment surpassed the other treatments during the progressive and the whole experimental period while the 60% CRM treatemt showed the lowest live weight values. The final value of live weight at 8 weeks of age was the highest for 0.0% CRM (1762.7 g) then decreased progressively with increasing the level of CRM in the diet to give the lowest value with the 60% CRM treatment (1615.7 g).

Table 3: Effect of feeding different levels of CRM on the performance of Arbor Acres broiler chicks (Experiment 2).

Item \ Treatment	Dietary CRM level in place of YC 0.0%	20%	40%	60%
No.of birds	90	90	90	90
Initial live weight (g)	38.3±0.20	37.1±0.09	37.7±0.44	37.1±0.10
Live weight after 2 wks[1] (g)	179.8±5.50	162.6±3.24	166.4±3.91	149.5±3.12
Live weight after 4 wks (g)	667.9±9.59	650.8±15.03	592.1±14.63	571.7±2.01
Live weight after 6 wks (g)	1239.6±9.36	1188.6±33.70	1130.3±10.78	1066.8±5.26
Live weight after 8 wks (g)	1762.7±18.82	1706.4±28.96	1674.8±9.62	1615.7±10.93
Live weight gain (g/day):				
Starter period 0-2 wks	10.11±0.38^{a}	8.96±0.23^{b}	9.19±0.26^{b}	8.03±0.23^{c}
Grower period 2-4 wks	34.86±0.71^{a}	34.87±0.88^{a}	30.41±0.85^{b}	30.16±0.31^{b}
Grower period 4-6 wks	40.84±0.68^{a}	38.41±0.42^{ab}	38.44±0.28^{a}	35.36±0.45^{b}
Finisher period 6-8 wks	37.36±0.68^{bc}	36.98±0.57^{c}	38.89±0.70^{ab}	39.21±0.51^{a}
Overall period 0-8 wks	30.79±0.33^{a}	29.81±0.52^{b}	29.23±0.17^{c}	28.19±0.20^{d}
Feed consumption (g/day):				
Starter period 0-2 wks	15.93±0.28^{a}	15.52±0.24^{ab}	15.76±0.46^{a}	15.08±0.24^{b}
Grower period 2-4 wks	53.36±0.44^{b}	56.26±1.18^{a}	53.15±0.77^{b}	52.24±0.16^{b}
Grower period 4-6 wks	95.98±0.36^{a}	96.49±0.99^{a}	95.86±2.91^{a}	97.01±1.42^{a}
Finisher period 6-8 wks	108.21±1.52^{b}	110.94±0.20^{ab}	114.05±0.65^{ab}	116.25±2.78^{a}
Overall period 0-8 wks	68.37±0.33^{a}	69.82±0.43^{a}	69.69±1.88^{a}	70.15±0.86^{a}
Feed efficiency (FE):[2]				
Starter period 0-2 wks	0.63±0.013^{a}	0.58±0.006^{b}	0.58±0.003^{b}	0.53±0.012^{c}
Grower period 2-4 wks	0.65±0.014^{a}	0.62±0.010^{ab}	0.57±0.008^{b}	0.58±0.003^{b}
Grower period 4-6 wks	0.42±0.007^{a}	0.40±0.014^{ab}	0.40±0.014^{ab}	0.36±0.009^{b}
Finisher period 6-8 wks	0.35±0.012^{a}	0.33±0.005^{a}	0.34±0.006^{a}	0.34±0.004^{a}
Overall period 0-8 wks	0.45±0.007^{a}	0.43±0.007^{ab}	0.42±0.005^{bc}	0.40±0.006^{c}

Means within the same row with different superscripts are significantly different ($P<0.05$).
1) wks = weeks. 2) FE = Unit gain/unit feed consumption.

At 2 weeks of age, the live weight gain (WG) of chicks fed on control (0.0 % CRM) diet was significantly higher ($P < 0.05$) than those of other treatments, followed by the chicks fed on 20 and 40% CRM diets. No significant difference was detected between the latter two rations, while those fed on 60% CRM diet gave significantly ($P < 0.05$) lower value than those of the other three treatments. Results during the second fortnight period (2-4 weeks of age) showed that the WG of 20% CRM was getting closer to that of the control (0.0% CRM). The same trend was obtained for the 60% CRM which improved to give the same value as that of 40% CRM. Nevertheless, the values of both 40% and 60% CRM treatments were significantly ($P < 0.05$) lower than those of 0.0 and 20% CRM.

During the period of 4-6 weeks of age, it was clear that the diets containing 20 and 40% CRM gave similar WG to that of the control, since the differences among the diets were not significant ($P< 0.05$). The WG of chicks fed on 60% CRM diet improved in such period to approach the values of 20 and 40 % CRM diet. No significant difference was detected between the diets of 60 and 20% CRM. It is of interest to record that the WG of chicks fed 60% CRM diet, surpassed all other treatments during the period of 6-8 weeks of age. Although the value of 60% CRM was significantly similar to that of 40% CRM, it was significantly higher than those of the control (0.0% CRM) and of 20% CRM diet as both were significantly similar. It seemed that the response of chicks to utilize CRM was increased with advancement of age, showing distinctly compensatory growth effect perhaps due to more adaptability of chicks to diets higher in CRM.

The overall results during the experimental period (0-8 weeks of age) showed that chick WG significantly ($P< 0.05$) decreased with increasing level of CRM in the diets from 0.0 to 20, 40 or 60%.

Therefore, it could be concluded that the ability of chicks to utilize CRM increased with age. It could be recommended not to include CRM in chick diets during the first fortnight period. It could replace YC at a level of 20% during the second fortnight, a level of 40% during the third fortnight and a level of 60% during the last fortnight period (6-8weeks of age). This observation is worth to be experimentally tested in future.

No consistent trend was observed in the feed consumption (FC) among different treatments. However, there was a tendency towards decreased FC as the level of CRM in the diet increased during the first 4 weeks of age, but not during the later periods. The FC values were significantly ($P < 0.05$) similar for all treatments during the period of 4-6 weeks of age. During the 6-8 weeks of age the FC was increased with increasing the level of CRM in the diet up to 60%. Although the FC of 60% CRM diet was significantly similar to those of 40 and 20% CRM diets, it was significantly higher ($P < 0.05$) than that of the control. It seemed that the birds were reluctant to consume the CRM diet at the beginning of the experiment, probably due to the unpalatability of the powdery nature of root meal. It might be due to that CRM contained a factor that diminished feed consumption during the first weeks of life. As the birds grew older they were more tolerant to receive higher levels of CRM diet. However, the mean values of the overall experimental period (0-8 weeks of age) showed that all the birds exhibited significantly ($P < 0.05$) similar response in FC to the different diets.

The results concerning feed efficiency (FE) nearly followed a similar trend to that recorded for WG and FC.

The FE generally decreased with increasing level of CRM in the diet during the first 3 successive fortnight periods (6 weeks of age).

The CRM-diet values start to approach gradually the control value during the above 3 successive periods to be similar at the fourth fornight period. However, the differences among all the treatments during the later period were not significant. This confirmed that the ability of chicks to utilize CRM increased with age. The overall mean value during the 8-week experimental period showed that FE decreased progressively with increasing the level of CRM in the diet from 0.0 to 20, 40 or 60%.

However, the FE of birds fed diets containing 20% CRM level compared favourably with that of control diet since no significant (P< 0.05) difference was detected between both of them. It is also interesting to note that replacing YC with 20% CRM produced better performance compared to other higher CRM level treatments. The depressed performance of chicks at higher levels of CRM might be due to the powdery nature affecting palatability of the diets.

On the basis of WG and FE of birds during this study, it might be concluded that CRM can replace YC into starter, grower and finisher diets at the levels of 0.0%, 20-40% (12-23% of diet) and 60% (37% of diet), respectively without adverse effect on performance, if the diets are balanced in respect of all nutrients. However, substitution of YC during the 8-week experimental period with up to 20% CRM (12% of diet) resulted in similar performance that compared favourably with the control.

The present results supported many investigators who demonstrated that increasing levels of CRM to chicks decreased their performance. Torres (1957-58) attributed his unsatisfactory results to unpalatability because of the powdery nature of CRM or to the presence of toxic factor in root meal when 30% of CRM replaced wheat bran and middlings in chick diet. Vogt(1966) incorporated up to 30% CRM into broiler rations. Productivity was normal with 10% but with 20 and 30% CRM, weight gain and feed efficiency deteriorated. The adverse effect occurred mainly in the first few weeks of life, but after the fourth week the broilers could consume CRM at higher levels than 10%. The author affirmed that the use of 10% CRM in broiler ration could be recommended without hesitation for the entire period of fattening. He also suggested that the presence of prussic acid in CRM and perhaps also the phosphorylase inhibitor in the rind of cassava tuber are responsible for the growth depression. The reduction in feed consumption was probably due to the powdery nature of cassava meal. Enriquez and Ross (1967) studied in 1-day old chicks the effect of incorporating up to 50% cassava root flour into broiler diets. Deterioration in weight gain and feed conversion at 3 weeks of age were observed when CRM levels in excess of 20% were used. The authors attributed these unsatisfactory results with the higher levels of CRM to its unpalatability because of its powdery nature.

The present data also supported Khajarern and Khajarern (1977) who studied the substitutional value of CRM for corn in broiler rations. No significant differences in body weight and feed conversion were noted for chicks receiving up to 30% substituted cassava pellets during the period of 1-4 and 4-8 weeks of age. However, in another experiment, significantly poorer body weight gain and feed conversion were noted during 1-5 weeks of age when the rations contained from 0.0 to 50% CRM with 10% increment. The authors also reported that body weight gain was not depressed until the rations contained more than 30% CRM. The ability of chicks to utilize CRM increased with age. Their results indicated that during 5-9 weeks and 1-9 weeks of age, there were no significant differences observed on body weight gain and feed conversion when the concentration of CRM increased in the rations. The decline in gain and poor feed conversion of chicks from feeding high levels of CRM might be due to the physical form, palatability and nutrient density of the diets.

Ademosun and Esheitt (1980) concluded that the starter and grower diets of layer-type chicks should not contain more than 15 and 30% , respectively. It was suggested that the absence of added fat and increasing the dusty nature of CRM diets might have limited the utilization of these diets at higher inclusion levels.

However, conflicting data have been obtained on the recommended levels of CRM that could be safely included in the diets of chicks. Klein and Barlowen (1954) recommended using cassava root flour at levels up to 10% because higher levels were reported to decrease weight gain and feed efficiency. They affirmed that cassava flour contained a factor that diminished feed consumption. Yoshida et al. (1966) found that young birds grew well when fed with 10% cassava root, but that higher levels resulted in delayed growth. The authors suggested that HCN present in flour (36 ppm) was responsible for the low level of growth.

Olson et al. (1969 a) concluded that peeled CRM could be incorporated into chick diets with levels up to 30% without sacrificing gain if the ration was balanced for energy and protein.

Chou and Müller (1972) substituted pelleted cassava root flour for corn flour at levels of up to 58%. They found that this substitution was possible provided that the diets were properly balanced with regard to other nutrients. The results of Pido et al. (1979) indicated that incorporating fermented cassava meal up to 50% in broiler rations produced no significant differences in live weight performance or carcass characteristics.

Recently, Stevenson and Jackson (1983) reported that the maximum recommended level of CRM inclusion in broiler diets was 30%.

Results of TPE (Table 4) showed nearly similar trend in response to CRM diets as previously recorded in this experiment for body weight gain and FE.

It is clear that TPE values generally decreased with increasing CRM level in diets during the first 6 weeks of age. But it seemed that the response of chicks to utilize CRM diet increased with advancement of age since during the period of 6-8 weeks of age the TPE values were significantly ($P < 0.05$) similar among different CRM diets. No significant treatment differences were detected between each of them and that of the control. However, the TPE values for the whole experimental period (0-8 weeks of age) slightly decreased with increasing CRM level in broiler diets. The 60% and 40% CRM diets was significantly inferior ($P < 0.05$) to the control but not to the 20% CRM diet. This indicates that the protein quality of 20% CRM diet compared more favourably with that of the control. This is a further support to FE finding that replacing YC with CRM up to 20%

Table 4: Effect of feeding different levels of CRM on TPE, MEU, GR and MR of Arbor Acres broiler chicks (Experiment 2)

Item \ Treatment	Dietary CRM level in place of YC 0.0%	20%	40%	60%
Total protein efficiency (TPE)[1]				
Starter period 0-2 wks[2]	2.84±0.06^{a}	2.62±0.03^{b}	2.70±0.02^{b}	2.48±0.06^{c}
Grower period 2-4 wks	3.26±0.07^{a}	3.14±0.05^{a}	2.87±0.04^{b}	2.90±0.02^{b}
Grower period 4-6 wks	2.13±0.04^{a}	2.01±0.07^{ab}	2.02±0.08^{ab}	1.83±0.05^{b}
Finisher period 6-8 wks	1.96±0.06^{a}	1.90±0.03^{a}	1.96±0.03^{a}	1.98±0.02^{a}
Overall period 0-8 wks	2.25±0.03^{a}	2.16±0.03^{ab}	2.14±0.02^{b}	2.06±0.02^{b}
Metabolizable energy utilization (MEU)[3]				
Starter period 0-2 wks	0.216±0.004^{a}	0.198±0.002^{b}	0.203±0.002^{b}	0.188±0.005^{c}
Grower period 2-4 wks	0.221±0.004^{a}	0.211±0.003^{ab}	0.198±0.003^{b}	0.199±0.002^{b}
Grower period 4-6 wks	0.144±0.002^{a}	0.135±0.005^{ab}	0.139±0.005^{ab}	0.126±0.003^{b}
Finisher period 6-8 wks	0.115±0.004^{a}	0.112±0.002^{a}	0.117±0.002^{a}	0.116±0.001^{a}
Overall period 0-8 wks	0.152±0.002^{a}	0.145±0.002^{b}	0.145±0.002^{b}	0.140±0.001^{b}
Growth rate (GR) %				
Starter period 0-2 wks	64.84±0.73^{a}	62.85±0.56^{b}	63.07±0.51^{b}	60.20±0.76^{c}
Grower period 2-4 wks	57.59±1.02^{ab}	60.02±0.36^{a}	56.11±0.56^{b}	58.55±0.74^{ab}
Grower period 4-6 wks	29.98±0.57^{a}	29.22±0.64^{a}	31.25±0.71^{a}	30.22±0.32^{a}
Finisher period 6-8 wks	17.42±0.15^{b}	17.91±0.59^{b}	19.41±0.39^{a}	20.46±0.18^{a}
Overall period 0-8 wks	42.46±0.04^{a}	42.50±0.13^{a}	42.46±0.15^{a}	42.36±0.09^{a}
Mortality rate (MR) %				
Starter period 0-2 wks	0.00^{a}	1.11^{a}	1.11^{a}	0.00^{a}
Grower period 2-4 wks	0.00^{a}	2.26^{a}	0.00^{a}	1.11^{a}
Grower period 4-6 wks	0.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}
Finisher period 6-8 wks	1.11^{a}	1.15^{a}	3.41^{a}	2.22^{a}
Overall period 0-8 wks	1.11^{a}	4.45^{a}	4.44^{a}	3.33^{a}

Means within the same row with different superscripts are significantly different ($P<0.05$).
1- Unit gain/unit protein consumed. 2- wks = weeks. 3- MEU = g gain/Kcal ME consumed.

to broiler diet has not any deleterious effects on chicks during the 8-week experimental period, if the diets were balanced in protein, energy and other nutrients.

Concerning the energy utilization, it is obvious that the chicks utilized the control diet most efficiently being better than the CRM diets. The metabolizable energy utilization (MEU) values indicated that increasing CRM level has detrimental effect on the MEU specially at the higher levels of 60% CRM diet which was significantly ($P < 0.05$) lower than that recorded for control during the different stages of the first 6 weeks of age. But no significant differences were detected among the CRM diets and control during the later period of 6-8 weeks of age. It seemed that the ability of chicks to utilize ME was improved with the advancement of age, since the lower values than the control were obtained on diets containing 20, 40, and 60% CRM during previous periods (0-2, 2-4 and 4-6 weeks of age) as tested statistically.

However, the overall MEU values during the whole experimental period (0-8 weeks of age) decreased with increasing CRM level. Although the differences among the CRM treatments were not significant, yet their MEU values were significantly inferior ($P < 0.05$) to that of the control. This might be due to the higher digestibility value of YC compared with that of CRM singly or in a combination with YC as obtained previously (El-Sherbiny et al., 1986 b) which might be reflected on MEU.

Concerning growth rate, a trend towards significantly ($P < 0.05$) poorer growth rates (GR) with increasing CRM level during the first 2 weeks of life was obtained (Table 4). The differences in GR among different treatments started to diminish by advancement of age to be equal at the second and third fortnights or even superior to that of the control at the last fortnight period (6-8 weeks of age). This is usually encountered in successive growth periods due to compensatory effect.

However, no significant differences were observed in the rate of growth when replacing YC with up to 60% CRM in broiler rations during the 8-week experimental period.

The results are in good agreement with those of Enriquez and Ross (1967) who observed poorer growth at 3 weeks of age when CRM levels were in excess of 20%. A number of workers have demonstrated that feeding higher level of CRM to chicks during the first few weeks of life decreased their GR (Rendon et al., 1969 and Maust et al., 1972). Ademosun and Eshiett (1980) reported that the tolerance of higher levels of CRM by grower chicks compared to starter seemed to suggest an age-linked capacity to utilize CRM more efficiently. On the other hand, some workers did not find any significant differences or adverse effect on growth rate for chicks receiving higher levels of CRM in their diets (Müller and Chou, 1971 and Hutagalung et al., 1973). The variation in performance data among the published and the present results might be due to differences in processing condition of cassava root before being introduced to chicks. It might be also due to the differences in bird ages used in experiments. The type of cassava used might be another reason for such changes.

Regarding mortality in all treatment groups , it was negligible during the experimental period. There was no significant differences in mortality rate during the different stages of life that could be ascribed to level of CRM in diets. It seemed that the cause of death was due to other reasons not related perhaps to toxicity of CRM.

Earlier findings showed that CRM is a satisfactory replacer for corn in chicks with no evidence of HCN toxicity (Enriquez and Ross, 1967; Olson et al., 1969 a; and Müller et al., 1971). On the other hand, Vogt (1966) concluded that, growth depression was observed when 20% or 30% CRM was fed to broilers. Perhaps, other future studies in this field might be useful to discover other biological factors related to introducing CRM in poultry rations.

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لايوجد فروق معنوية فىمعدل النفوق فى جميع المعاملات حتى مستوى ٦٠٪ فى مراحل النمو المختلفة مما يدل على عدم احتمال وجـــــود أى تـأثير سام لمسحوق درنـات الكاساڤا على الكتـاكيت .

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استعمال مسحوق جذور الكاسافا كغذاء للدواجن

٣) تأثير احلال مسحوق جذور الكاسافا محل الذرة الصفراء على انتاجية كتاكيت اللحم .

آمال السيد الشربينى ، محمد حسن رضوان ، محمد ابراهيم القطورى وأحمد محمود عباس .
قسم الانتاج الحيوانى - كلية الزراعة - جامعة القاهرة ومعهد بحوث الانتاج الحيوانى بالدقى .

أجريت هذه الدراسة بغرض الحصول على أفضل مستوى من مسحوق درنات الكاسافا يمكن أن يحل محل الذرة الصفراء فى علائق كتاكيت اللحم بدون أى تأثير ضار عليها .

اشتملت التجربة الأولى على ١٢ تجربة هضم (ثلاث ديوك بليموث روك بالغة فى كل تجربة) لتقدير القيم الغذائية للعلائق المستخدمة فى تجربة ٢ . وقد أثبتت النتائج أن كل مجموعة من هذه العلائق (بادئة أو نامية أو ناهية)كانت مماثلة تقريبا فى قيمها الغذائية . وعلى ذلك فان حدوث أى فروق فى انتاجية كتاكيت اللحم عند تغذيتها على هذه العلائق (تجربة ٢) سيعزى الى نوعية مسحوق درنات الكاسافا الموجودة فى العلائق .

أجريت التجربة الثانية لدراسة تأثير احلال نسب صفر ، ٢٠ ، ٤٠ ، ٦٠ ٪ مسحوق درنات كاسافا محل الذرة الصفراء فى علائق كتاكيت اللحم (بادئة - نامية - ناهية) على انتاجية هذه الكتاكيت . وكانت هذه العلائق متزنة فى جميع الاحتياجات الغذائية . وقد استخدم فى هذه التجربة ٣٦٠ كتكوتا عمر يوم من نوع أربر ايكرز قسمت الى أربعة معاملات x ثلاث مكررات ويشمل كل مكرر ٣٠ كتكوتا . أوضحت النتائج وجود انخفاض فى مقاييس الانتاجية فى بداية مراحل النمو خصوصا مع النسب العالية من الكاسافا حيث كانت استجابة الكتاكيت للاستفادة من الكاسافا منخفضة ولكن بتقدم العمر تحسنت النتائج مما يدل على زيادة استجابة الكتاكيت للكاسافا تدريجيا حيث كانت قيم الانتاجية متماثلة معنويا عند عمر ٦ - ٨ أسابيع . ودلت نتائج الوزن المكتسب والكفاءة الغذائية والكفاءة التحويلية للبروتين أن مسحوق درنات الكاسافا يمكن أن يحل محل الذرة الصفراء فى العلائق البادئة والنامية والناهية لكتاكيت اللحم بنسب صفر ، ٢٠-٤٠ ٪ (١٢ -٢٣ ٪ من العليقة) ، ٦٠ ٪ (٣٧٪ من العليقة) على التوالى بدون ضرر خصوصا عندما تكون العلائق متزنة غذائيا . كما أوضحت مقاييس الانتاجية أن مستوى ٢٠ ٪ مسحوق درنات كاسافا (١٢٪ من العليقة) كان مماثلا لمجموعة المقارنة طول فترة التجربة (من عمر يوم الى ٨ أسابيع).