EFFECTS OF FERMENTED TAPIOCA RESIDUE ON THE PERFORMANCE OF BROILERS

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SUMMARY: Graded levels (0, 30, 40 and 50%) of fermented tapioca residue (FTR) were incorporated into broiler rations and fed to 400 day-old Ross broilers for eight weeks. The birds were allocated into four treatments with eight replicates per treatment. The rations contained 12.8, 12.9, 12.6 and 12.7 MJ ME/kg and 22.9, 22.3, 22.9 and 23.3 percent crude protein respectively. Results indicate that FTR of up to 50 percent level had no effect on feed efficiency, feed intake and body weight gain when compared with control birds fed on a corn and soyabean based ration (0% FTR). FTR at 30 percent and 40 percent levels were cheaper than corn and soyabean based ration, but FTR at 50 percent level was slightly more expensive than the control diet. Nett income per bird over feed and chick cost was lowest for FTR at 30 percent and highest for FTR at 40 percent.

Key words: fermented, tapioca residue, broilers

INTRODUCTION

The total value of imported feedstuff for livestock in 1984 was 1,516,771 tonnes and valued at 620 million ringgit (Anon, 1986). The expansion of the poultry industry necessitates increased importation of feedstuffs. However, local investors are unlikely to venture into large scale production of feedstuffs since cultivation of oil palm, cocoa and rubber appear to be more lucrative. Price instability and uncertain supply of feedstuffs can cause serious losses to poultry farmers. Thus, the utilization of locally available feedstuff will not only reduce the dependence on imported feedstuff but also reduce cost of poultry ration.

Two by-products are usually available from tapioca (cassava) roots namely, tapioca peel and tapioca pulp (Devendra, 1982). A third by-product, fermented tapioca residue (FTR), is obtained after the supernatant fluid obtained from centrifugation is allowed to ferment in tanks. The fermentation process involved is an uncontrolled one and the residue is allowed to dry in the tanks.

This study was undertaken to evaluate the potential of fermented tapioca residue in poultry rations. The objectives of the study were to determine the optimum levels at which fermented tapioca residue could be incorporated in broiler rations and also the economics of such a substitute in broiler rations.

MATERIALS AND METHODS

Animals

Four hundred day-old Ross chicks were allocated in groups of 12–13 birds per replicate to four dietary treatments (R1, R2, R3 and R4). Each treatment was replicated eight times in a completely randomised design. All birds were raised on wired floor cages (122 cm x 92 cm x 31 cm). Rations and water were offered *ad libitum*. The birds were vaccinated against Newscastle disease at day-old and three weeks. Records of body weight gain were taken weekly.

Diet

Four rations were prepared containing increasing proportions of FTR (0, 30, 40 and 50%). The composition of the ration is given in Table 1. An attempt was made to maintain the crude protein levels isonitrogenously by increasing the proportions of soyabean and fishmeal. Palm oil was also added for isocaloric balance of the ration. Records of feed intake were taken weekly.

TABLE 1
Composition and cost of experimental rations

Ingredients	R_1	R_2	R_3	R_4
	%			
Maize	54	20	9	–
Fermented tapioca residue	–	30	40	50
Palm kernel cake	–	10	6	–
Soyabean meal	35.2	27	28	32
Fish meal	4	10	12	12
Crude palm oil	4	2	4	4.5
Premix + methionine + lysine	0.5	0.5	0.5	1.0
Di-calcium phosphate	2.0	0.5	0.5	0.5
Salt	0.24	–	–	–
Total	100	100	100	100
Cost per 100 kg (Malaysian ringgit)*	59.78	55.78	58.13	61.20
Calculated analysis:	%			
Crude protein	22.90	22.34	22.87	23.25
M.E. (MJ/kg)	12.78	12.91	12.62	12.67
Crude fiber	3.80	4.51	3.69	2.90
Calcium	1.00	1.01	1.21	1.27
Phosphorus	0.48	0.66	0.71	0.81
Methionine	0.48	0.41	0.42	0.42
Lysine	1.36	1.01	1.05	1.08
Premix:	g			
Rovimix 428/3**	25	30	32	35
Trace mineral mixture	50	55	60	65
Antioxidant (BHT)	100	100	100	100
Furazolidone	50	50	50	50
DL–methionine	200	200	200	400
Lysine	400	400	400	600
Daimethon	5	5	5	5

* Cost per metric tonnes (Malaysian ringgit) of six major raw materials: maize, 397; fermented tapioca residue, 240; palm kernel cake, 350; soyabean meal, 612; fish meal, 992 and crude palm oil, 925.

** Rovimix 428/3 per kg contains Vit. A, 50 Mio IU; D_3, 10 Mio IU; E, 75g; B_1, 10g; B_2, 30g; B_{12}, 0.1g; B_6, 20g; K_3, 20g; Nicotinic acid, 200g; Pantothenic, 60g and Folic acid, 50g.

Costing and analysis

The feed cost and the cost of production per kg liveweight were calculated from the market prices of feed ingredients and birds. The performance data were analysed by analysis of variance and tests for significance were carried out by Least Significant Difference according to Steel and Torrie (1980).

RESULTS AND DISCUSSION

The results of the analysis of three samples of fermented tapioca residue showed that the composition of the product was somewhat variable: moisture content, 8–13%; ash, 3.2–3.4%; protein, 0.24–3.4%; phosphorus, 0.02–0.17% and crude fibre, 0.65–1.08%. The chemical composition of FTR used in the experimental diets is given in Table 2. FTR was low in most of the nutrients; however, the percentage of crude protein of FTR used in this experiment was much higher than that for tapioca (Yeong and Syed Ali, 1976a).

TABLE 2
Chemical composition of fermented tapioca residue

	%
Dry matter	91.82
Moisture	8.18
Ash	3.24
Crude protein	3.40
Crude fiber	1.08
Phosphorus	0.17
Gross energy	15.68 kJ/g

The total body weight gain, total feed intake and feed efficiency of birds fed FTR at 0, 30, 40 and 50 percent are given in Table 3. The birds fed FTR at 0 and 40 percent were significantly heavier than other birds. It is difficult to account for the low body weight for birds fed FTR at 30 percent level. The highest feed intake was observed in birds fed FTR at 40 percent but birds fed at 0 and 30 percent had a significantly lower feed intake. Thus, there were no significant differences in the feed conversion among the four groups of birds.

The mortality rate is given in Table 4. The highest mortality was observed in the control group (0%) and the lowest in the 30 percent group. Two factors were responsible for the deaths. Some of the birds were killed by predators while the others died of suspected toxic fat syndrome. Most of the birds in the control group died of toxic fat syndrome probably due to the high level of low quality crude palm oil in the ration. Post-mortem findings revealed accumulation of serous fluid in the abdominal and pericardial cavities, and generalised congestion of the vital organs. Flick *et al.* (1966, 1967) also observed toxic fat syndrome with birds fed on a diet rich in crude palm oil.

FTR birds had pale coloured shanks. Yeong and Syed Ali (1976a, b) and Hutagalung *et al.* (1974) also observed similar findings and suggested that this could be corrected by the addition of synthetic carotene or even by the addition of tapioca leaves in the diets.

TABLE 3
Effect of fermented tapioca residue on the performance of broilers from day-old to eight weeks

Treatments	Total body weight gain (kg/bird)*	Total feed intake (kg/bird)*	Feed conversion efficiency
R_1	1.8414^{a}	3.9633^{a}	2.15^{a}
R_2	1.6177^{b}	3.7811^{b}	2.34^{a}
R_3	1.8744^{a}	4.2076^{c}	2.24^{a}
R_4	1.7933^{ab}	3.8834^{ab}	2.17^{a}

* Means in the same vertical columns bearing different superscripts differ significantly ($P > 0.05$).

TABLE 4
Mortality of the broilers during feeding trial

Treatment	No. per group	No. survived	% Mortality
R_1	100	85	15
R_2	100	96	4
R_3	100	92	8
R_4	100	91	9

The cost-benefit evaluation (Table 5) showed small differences in cost per kg feed and production cost per kg live weight. The feed cost per kg for diets containing FTR at 30 and 40 percent were cheaper than the control, but the diet containing 50 percent FTR was more expensive because of the higher amounts of fish meal, premix methionine and lysine (Table 1). The feed cost per kg liveweight was lowest in the control group (RI) and diets containing FTR were generally more expensive (Table 5). The main ingredient that caused the higher price differential was fish meal. Amounts up to three times were used in the FTR diets. The nett income per bird over feed and chick cost was estimated (Table 5) and the highest value was obtained for birds fed FTR at 40 percent while the lowest value was recorded for birds fed FTR at 30 percent. Birds fed FTR at 30 percent recorded the lowest body weight gain and this accounted for the low value for nett income per bird over feed cost.

In conclusion, FTR up to 50 percent can be incorporated in broiler diets without deleterious effects. However, more experiments have to be conducted to find replacements for fish meal as a source of protein in the effort to reduce the cost of FTR diets. The results of this study also showed that FTR can be substituted for maize particularly when the price of maize is high.

TABLE 5
Cost benefit evaluation of the experimental rations

Treatment	Chick* cost	Feed cost/ kg live wt	Total feed cost/bird	Income/kg live wt	Income/ bird	Nett income/ kg live wt over feed cost	Nett income**/ bird over feed and thick cost
R_1	$1.15	$1.28	$2.36	$2.30	$4.23	$1.02	$0.72
R_2	$1.04	$1.35	$2.18	$2.30	$3.73	$0.95	$0.51
R_3	$1.08	$1.30	$2.44	$2.30	$4.30	$1.00	$0.78
R_4	$1.09	$1.33	$2.37	$2.30	$4.11	$0.97	$0.65

* Chick cost adjusted for mortality.

** Income per bird minus feed cost per bird and chick cost.

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RINGKASAN

KESAN SISA PENAPAIAN UBI KAYU DALAM PRESTASI AYAM PEDAGING.

Sisa penapaian ubi kayu telah dicampurkan dengan ramsum ayam pedaging pada tahap-tahap tertentu (0, 30, 40 dan 50%) dan diberi makan kepada 400 ekor anak ayam pedaging Ross yang berumur satu hari hingga lapan minggu. Anak-anak ayam ini telah dibahagikan kepada empat perlakuan dimana setiap perlakuan mempunyai lapan replika. Ransum-ransum untuk perlakuan yang tersebut diatas mengandungi 12.78, 12.91, 12.62 MJ ME/kg serta 22.9, 22.7, 22.34 dan 23.25 peratus protein kasar. Keputusan yang diperolehi menunjukkan bahawa penggunaan sisa penapaian ubi kayu sehingga tahap 50 peratus tidak memberi apa-apa kesan dari segi kecekapan pemakanan, pengambilan makanan

dan kenaikan berat badan jika dibandingkan dengan anak-anak ayam bandingan yang telah diberi makan ransum yang mengandungi jagung dan kacang soya (0% FTR). Penggunaan sisa penapaian ubi kayu pada tahap 30 dan 40 peratus adalah lebih murah daripada ransum jagung dan kacang soya, manakala penggunaannya pada tahap 50 peratus adalah lebih mahal daripada ransum bandingan. Pendapatan bersih dari setiap ekor ayam selepas ditolak kos makanan dan anak ayam adalah paling rendah bagi penggunaan sisa penapaian ubi kayu pada tahap 30 peratus manakala tertinggi pada tahap 40 peratus.