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THE EFFECT OF CASSAVA CHIP QUALITY ON THEIR USE IN POULTRY FEEDS

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RINGKASAN

Enam jenis makanan, lima darinya mengandongi 50% serpihan ubikayu yang berlainan mutunya telah digunakan sebagai makanan tumbesar ayam daging yang berumur empat minggu untuk selama enam minggu lebih. Mutu serpihan-serpihan ubikayu dalam makanan-makanan tersebut tidak meninggalkan kesan ke atas pengambilan makanan tetapi meninggalkan kesan ke atas kecekapan pengubahan makanan. Kepekatan garam yang tinggi yang digunakan bahan pencegah busuk, dalam dua dari makanan-makanan tersebut telah menyebabkan berak cair dan kematian yang tinggi. Manakala serpihan-serpihan ubikayu yang telah diadunkan dengan garam, disimpan selama dua minggu sebelum dikeringkan dibawah cahaya matahari tidak meninggalkan kesan yang buruk ke atas pemgambilan atau kecekapan pengubahan makanan, tetapi memberi makan serpihan-serpihan ubikayu yang telah disimpan untuk jangkawaktu yang pendek telah menyebabkan kecekapan pengubahan makanan lebih rendah dan keracunan. Penyelidikan lebih lanjut adalah dikehendaki untuk menentukan tabiat keracunan dan paras yang tepat untuk menggunakan ubikayu bergaram didalam makanan ayam dan ternakan yang lain.

INTRODUCTION

Considerable concern has been expressed about the possible influence of quality of cassava (*Manihot esculenta* Crantz) products and their use in animal feeds (MATHOT, 1974). In the fresh state cassava roots deteriorate rapidly and become unfit for food or industrial usage within 3 to 10 days although techniques for storing fresh roots for up to 2 months have been developed (BOOTH, 1977). Most of cassava used in animal feeds is processed and sun dried as chips immediately after harvesting. During sunny weather good quality, white coloured chips are produced following 1 to 3 days sun drying but under cloudy and rainy conditions the drying time is extended to 6 or more days and chips with a grey/brown dirty colour, bad odour and high moisture content are commonly produced. The high moisture frequently encourages mould development during handling and storage.

Chip quality may be enhanced by using mechanical drying systems that are independent of weather conditions or by speeding-up the sun drying process by producing chips with a geometry associated with rapid drying characteristics and selecting near optimal chip loading rates on drying yards. Alternatively chemical preservatives which maintain the apparent chip quality irrespective of drying time may be used. One such chemical method is to mix cassava chips with commercial salt and which has been shown to be effective in preventing chip deterioration during wet chip storage for periods up to 12 months (DURATE, 1960, ANON, 1963) and during slow sun drying (BOOTH and DHIAUDDIN, in preparation).

In a comparison of freshly harvested with stored cassava roots, BOOTH *et al.*, (1976) found that feed intake by pigs was lower with stored but apparently undeteriorated roots and they suggested that changes in texture and organoleptic factors could, in addition to hydrocyanic acid content, influence feed quality. There is no information available on the influence of quality of sun dried cassava chips on their use in animal feeds. This paper reports preliminary trial set-up to investigate the possible influence of quality and the use of salt as a preservative on the feeding value of cassava chips incorporated into broiler rations.

MATERIALS AND METHODS

Preparation of cassava chips

Cassava roots (Cultivar Black Twig) were harvested at 12 months of age and chipped within 48 hours of harvested using a Sirim Tapioca chipper. Five 1 ton samples were prepared as shown in *Table 1.* After drying the moisture content the apparent quality of each chip treatment was determined prior to immediate use in the preparation of feed rations. The apparent quality of the dried chips was assessed by a trained panel of five people. Each sample was evaluated on a 1 (very good) to 5 (very bad) scale for both colour and texture.

Preparation of feed rations

Six rations were prepared, one using yellow maize as the carbohydrate source and five using each of the above described chip treatments as outlined in *Table 2.* In the five cassava diets DL-methionine was added to fortify the sulphur amino acids required for detoxification of any hydrocyanic acid present in the cassava chips. The calculated constituents of the diets are also presented in *Table 2.*

Feeding trial

A total of 288 four week old broiler chickens of a commercial strain were used. They had been previously reared on a common 22% crude protein broiler starter ration. The chicks were randomly grouped in lots of 16 into 18 rectangular cages (182 x 91 x 46 cm.) with raised wire floors. The six diets *(Table 3)* were each fed in a non-pelleted form to three replicate lots together with water *ad libitum* basis. Feed intake and chick body weight were recorded weekly over the six week period of the trial. The trial was terminated when the chicks were 10 weeks old.

TABLE 1. CASSAVA CHIP TREATMENTS

Treatment code	Treatment	Dry chip quality score[1]
A	Fresh chips, no salt, fast (2 days) sun drying	1.2 (very good)
B	Fresh chips, no salt, slow (6 days) sun drying	5.0 (very bad)
C	One week pre-drying storage of chips, no salt, fast sun drying	3.0 (bad)
D	One week pre-drying storage of chips plus salt, fast sun drying	1.8 (good)
E	Two week pre-drying storage of chips plus salt, fast sun drying	2.0 (good)

1 Min. score = 1 (very good), max. score = 5 (very bad)
2 3g NaCl mixed with 100g of wet chips, i.e. 3% salt in wet chips
3 Chip stored in half ton wooden bins and exuded liquor allowed to drain away.

RESULTS AND DISCUSSION

The moisture content of all cassava chip treatments was between 11% and 13%. The quality of the different cassava chip treatments incorporated into the five cassava diets (diets 2–6) is shown in *Table 3*. The rapidly dried unstored chips (treatment A) and those which had been stored for one and two weeks after treatment with salt (treatments D and E) received a high quality score. The chips which had been stored for one week without salt (treatment C) received a low quality score and had a bad odour due to the decay which had occurred during storage. Chips which had received no treatment but which were dried slowly (treatment B) also received a low quality score.

The results of the broiler feeding trial *(Table 4)* showed that there were no significant differences in feed intake or body weight gain between any of the diets. The presence of salt (about 5% in the final feed) in diets 5 and 6 and the poor quality of the chips as assessed by the panel, used in diets 3 and 4 did not reduce feed intake. The faeces of chickens fed diets containing salt-treated chips was markedly wetter than those of chicks fed with the other diets. The optimum salt level for chicken diets is around 0.37% (N.C.R., 1971), and according to KRISTA *et al.*, (1961). 0.7% salt in the diet is toxic to chickens. Since the salted cassava diets contained approximately 5% salt it was expected that the chickens would drink more water in an attempt to flush out the excess salt, thus resulting in watery faeces.

There was no significant difference in feed efficiency (feed/gain) between the maize control diet and the cassava diets 2, 3, 4 and 6. However, there was a trend indicating a consistently better feed efficiency with diets 2 and 6 incorporating apparently good quality chips than with diets 3 and 4 incorporating apparently bad quality chips. The presence of a high salt concentration in diet 6, which had been stored for two weeks following treatment, did not reduce feed intake or efficiency as compared with other good quality cassava or maize diets (diets 2 and 1). The feed efficiency of diet 5 which contained salt treated chips which had only been stored for one week before drying was significantly poorer ($P > 0.05$) than any of the other diets.

Chicken mortality was low in those groups fed the maize diet and cassava diets which had not been stored or received salt treatment (diets 2 and 3). Mortality was considerably increased with diet 4 which contained chips which had been stored for one week prior to drying without any salt treatment. The quality of these chips was poor and increased mortality was possibly due to the presence of toxins produced by microbes during the decay of the chips while in storage. Mortality was very high with diet 5 which contained apparently good quality chips which had been treated with salt stored for one week prior to drying. Although the mortality rate with diet 6 was higher than with the control diets (diets 1 and 2), it was lower than that of either diet 4 or 5. In addition to the salt treatment, these chips had been stored for two weeks prior to drying and incorporation in the diet. It is suggested that the increased mortality with diet 6 was due largely to the high salt concentration and that the additional mortality with diet 5, which contained a similar high salt concentration, may have been due to the presence of higher concentrations of cyanogenic compounds or other toxins.

Available information suggests that treatment with salt may enhance cyanide loss, possibly due to increased membrane osmotic rupture resulting from salt treatment thus causing a breakdown in the linamarin-linamarase compartmentation and causing increased loss of resulting free cyanide (R. COOKE, TPI, pers. comm). Similarly, there are indications that the storage of chips prior to drying reduces cyanide loss on drying and increases the free to bound cyanide ratio, but after only seven days storage following salt treatment chips have been found to have

TABLE 2. INGREDIENTS AND CALCULATED CONSTITUENTS OF BROILER FINISHING DIETS

	Ingredients[1]	Maize Diet	Cassava Diets[2]
A.	Yellow maize	61.0	–
	Cassava chips	–	50.0
	Soyabean meal	25.0	37.3
	Fish meal	7.0	7.0
	Grass meal	2.0	–
	Palm oil	2.5	3.0
	Tricalcium phosphate	1.5	1.5
	Salt	0.25	0.25
	Vitamin – Mineral mix[3]	0.75	0.75
	DL–methionine[4]	–	0.2
B.	Calculated constituents (%)		
	Crude protein	20.07	20.0
	Ether extract	5.73	4.62
	Crude fibre	3.35	1.20
	Calcium	1.12	1.20
	Phosphorus	0.86	0.91
	Metabolizable energy (MJ/Kg)	13.0	12.1
	Lysine	1.18	1.40
	Methionine	0.38	0.54
	Cystine	0.34	0.31

1 Expressed as % of diet on fresh weight basis
2 Cassava diet is common to all five chips treatments
3 Commercial premix "Ferma-Vite", Hoffman–Taff Inc., Springfield, Missouri, USA.
4 DL–methionine is added in for hydrocyanide detoxication in ordinary cassava diet.

TABLE 3. EXPERIMENTAL DIETS

Diet No.	Treatments	Diet	Salt Treatment	Storage Treatment	Sun drying	Apparent quality of chips
1	–	Yellow maize control	–	–	–	–
2	A	Cassava control I	No salt	No storage	Fast	Very good
3	B	Cassava control II	No salt	No storage	Slow	Very bad
4	C	Cassava stored I	No salt	7 days storage	Fast	Bad
5	D	Cassava stored II	3% salt	7 days storage	Fast	Good
6	E	Cassava stored III	3% salt	14 days storage	Fast	Good

TABLE 4. FEED CONSUMPTION, BODY WEIGHT GAIN, FEED EFFICIENCY AND MORTALITY IN BROILERS FED SIX EXPERIMENTAL FINISHING DIETS

Diet No.	Total body weight[1] gain (g)	Total feed[1] intake (g)	Feed efficiency[2] (feed/gain)	% Mortality
1	1157.2	3995.0	3.45^{a}	8.3
2	1031.3	3576.4	3.47^{a}	4.2
3	962.1	3489.2	3.63^{a}	6.3
4	1059.2	4023.6	3.80^{ab}	18.8
5	1006.7	4553.2	4.52^{b}	31.3
6	1210.7	3673.2	3.03^{a}	12.5

1 Expressed on a per chicken basis
2 Figures with different superscripts are significantly different ($P>0.05$)

both higher total and free cyanide content than those stored for 14 days (R. COOKE, TPI, pers. comm). This higher cyanide content may account for the considerably increased mortality with diet 5 over that of diet 6, or other toxins may have been formed following salt treatment which with increased storage time were leaked out of the chips with the exuded drainage liquor.

The hypothesis is supported by observations in Brazil where farmers using salt to preserve cassava chips in the wet state in wooden storage bins warn against the high toxicity of drainage liquor. They also suggest that salt treated cassava should be stored under slight pressure, to encourage drainage, for 20 days before being utilised in animal feeds.

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SUMMARY

Six diets, five containing 50% cassava chips of varying quality, were fed as finishing diets over a six week period to four week old broilers. The quality of cassava chips incorporated into the diets did not affect feed intake but did appear to influence feed efficiency. The presence of high salt concentrations, used as a preservative, in two of the cassava diets resulted in diarrhoea and increased mortality. Where salt treated cassava chips were stored for two weeks prior to sun drying the presence of a high salt concentration in the diet had no adverse effect of feed intake or efficiency but feeding similar chips stored for a shorter period resulted in reduced feed efficiency and toxicity. Further research is required to determine the nature of this toxicity caused when cassava is fed shortly after salt treatments, and the optimum levels of salt treated cassava in diets for poultry and other farm animals.

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