Effect of cassayeast produced from varying combinations of cassava (*Manihot esculenta*) and brewers' dried yeast (*Saccharomyces cerevicea*) on broiler performance

Efecto del cassayeast producido a partir de varias combinaciones de yuca (*Manihot esculenta*) y levadura (*Saccharomyces cerevicea*) seca de cerveza sobre el comportamiento de pollos de engorde

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ABSTRACT

A feeding trial using 480 day-old Anak broiler chicks was conducted in which cassava meal (CM) fortified with brewers' dried yeast (BDY) completely replaced maize in four out of five isocaloric and isonitrogenous diets. The objective was to determine the influence of cassayeast produced from varying combinations of cassava (*Manihot esculenta*) and brewers's dried yeast (*Saccharomyces cerevicea*) on broiler performance. Dried CM blended with BDY formed cassayeast in the ratios of 30/11.1; 35/12.94; 40/14.79 and 45/16.64 in dietary treatments B, C, D and E, respectively. Diet A (control) contained maize without the test ingredient. Results showed significant differences (P<0.05) in feed intake, body weight gain, efficiency of feed utilization (Feed: gain and gain: feed ratios) and weights of breast and liver. Gizzard weights were similar (P>0.05). The study demonstrated that the use of cassayeast could improve feed availability in the broiler industry. It also showed that with proper protein balancing, cassayeast can completely replace maize in broiler diets.

Key words: brewers' dried yeast, cassava meal, cassayeast, broiler performance

RESUMEN

Se realizó un ensayo de alimentación utilizando 480 pollos broiler Anal de un día de vida en el cual la harina de yuca (HY) fortificada con levadura seca de cerveza (LSC) reemplazó completamente al maíz en cuatro de las cinco dietas isocalóricas e isonitrogenadas. El objetivo fue determinar el efecto del cassayeast producido a partir de varias combinaciones de yuca (*Manihot esculenta*) y levadura (*Saccharomyces cerevicea*) seca de cerveza sobre el comportamiento de pollos de engorde. La HY seca mezclada con LSC formó el cassayeast en las proporciones de 30/11,1; 35/12,94; 40/14,79 y 45/16,64 en los tratamientos dietéticos B, C, D y E, respectivamente. La dieta A (control) contenía maíz sin el ingrediente de prueba. Los resultados mostraron diferencias significativas (P<0,05) en el consumo de alimento, ganancia de peso corporal, eficiencia de utilización del alimento (Relaciones alimento:ganancia y ganancia/alimento) y los pesos de pechuga e hígado. Los pesos de la molleja fueron similares (P>0.05). El estudio demostró que el uso de cassayeast podría mejorar la disponibilidad de los alimentos en la industria de pollos de broiler. También mostró que con el equilibrio adecuado de proteínas, el cassayeast puede reemplazar completamente al maíz en las dietas de engorde.

Palabras clave: levadura seca de cerveza, dieta de engorde, harina de yuca, cassayeast

INTRODUCTION

Dietary energy is the most expensive nutrient in manufactured poultry feeds in Nigeria because of the inclusion proportion (40-70%) of the main energy ingredient, maize (Canter, 1987, Oruwari *et al*. 1995). Moreover, pressure from population growth, drought, inorganic fertilizer cost and intensive poultry production has made this conventional feed ingredient insufficient and therefore expensive. Also, the insufficient production and stiff competition between man and industrial use of maize has made it less economical for use in poultry production. Thus, the need for research to identify cheap and locally available energy feedstuffs in Nigeria such as cassava (*Manihot esculenta*) root meal and the by-products of its proccessing. Nigeria has comparative advantage in cassava production, which apart from industrial uses can be used to feed livestock.

This study was to investigate the best way of fortifying cassava, which is known to be energy feed stuff although popularly used as a staple food in sub-Saharan Africa (IITA, 1994). Previous research (Babiker *et al*. 1991 ; Ogbonna *et al*, (1996); Patterson *et al*. 1994) had been on partial replacement of maize with cassava meal and not total replacement, but that the potentials of utilisation of cassava as a major feed ingredient is hampered by it poor quality and low protein content. Furthermore, fortification of the cassava meal with a cheap, locally available protein source such as brewers' dried yeast (*Saccharomyces cerevicea*) is a new concept. For instance, Kotrbaceki *et al*. (1994) used brewers' yeast as a biological feed supplement in broiler diets.

Considering that cassava contain relatively lower crude protein levels than maize, the use of brewers' dried yeast costing \$0.21/kg to fortify cassava meal which costs only \$0.31/kg could provide a cheaper source of energy than maize at \$0.78/kg.

The objective was to determine the effect of cassayeast produced from varying combinations of cassava (*Manihot esculenta*) and brewers's dried yeast (*Saccharomyces cerevicea*) on broiler performance.

MATERIALS AND METHODS

Peeled, dried cassava (TMS-30555) and locally dried brewers' yeast were subjected to proximate analysis (AOAC, 1990). Cassava was also treated (Ezeala and Okoro, 1986) for hydrogen cyanide (HCN). The resulting chemical composition of cassava was 2.00% CP, and 1.30% fat, while that of brewers' dried yeast (BDY) was 28.09% CP and 4.80% fat. A blend of cassava meal (CM) and BDY (cassayeast) was made to achieve about 9,00% CP, to correspond with the CP content of the maize used. Accordingly, every 2.704 parts of CM was blended with one part of BDY (2.704 CM:1 BDY) resulting in a proximate composition of 9.01% CP, 2.25% fat, 9.56% crude fibre, 4,00% ash and 2,790Kcal/kg M.E (calculated).

Five isocaloric and isonitrogenous broiler diets were formulated (Table 1), such that: Diet A (control diet) contained 55,00% maize while the four test diets, B, C, D and E contained 41.10, 47.94, 54.79 and 61.64% cassayeast, respectively, replacing maize. The diets were analyzed for CP and fat only, while other nutrients were calculated based on the feed ingredient composition data used (Parr, 1988). Four hundred and eighty day-old broiler chicks were weighed in groups of 24 chicks and randomly allocated to twenty pens (2 x 3m each) in an open-sided house. Management procedures including vaccination were uniform for all birds. The birds were randomly assigned to the five dietary treatments, which were replicated four times in a completely randomized design, thus each of the 20 pens contained 24 chicks. The diets and water were provided *ad libitum*. The diets were fed to the birds for a total of eight weeks.

At the end of each period of seven days the birds were weighed individually to determine body weight gain and feed consumption for the calculation of feed: gain ratio and gain: feed ratio. Feed consumption was calculated by difference between the quantity offered and the quantity left over. In this study, gain: feed ratio was calculated to determine the biological status of protein fortification of cassava meal (cassayeast) in place of maize in broiler diets, while feed: gain was calculated for the commercial importance of cassava in the cassayeast. Final body weight was taken at the end of the eighth week: Post mortem examination performed on ten dead birds in treatments A, C and D in the fifth week showed that the cause was coccidiosis and not dietary treatment.

At the end of the eight weeks of experimental period, five birds from each replicate were weighed and slaughtered to determine breast weight, liver and gizzard weights. These were calculated and expressed as percentages of individual body weights.

All data collected were subjected to analysis of variance and treatment means separated by using the multiple range test of Duncan (1955)

RESULTS AND DISCUSSION

The results of feed intake, body weight gain and efficiency of feed utilization (gain:feed and feed: gain) (Table 2) showed that birds in treatment A, the maize based diet consumed ($P<0.05$) higher quantity of feed than birds fed cassayeast based diets. Within the cassayeast diets, birds in treatments B (41.10% cassayeast) and C (47.94% cassayeast) consumed significantly ($P<0.05$) more feed than birds in treatments D and E. The results agreed with the finding that feed intake was lowered at 25, 50 and 75% cassava replacement of maize (Babiker *et al.* 1991). Although the diets were isocaloric, birds in treatments B and C significantly consumed more feed than those on other cassayeast diets, probably because of physical limitations such as palatability, fibre level or eye and respiratory tract irritation (Parr, 1988). The bitter taste of BDY (Ensminger and Olentine, 1978) could have contributed to depressed intake. This study, moreover, exceeded the recommended inclusion level of 5.00% (Parr, 1988), 9.26% (Ergul, 1988). Its preparation inevitably could not avoid high level fibre which according to Oruwari *et al.* (2003) can depress feed intake.

The residual cyanide in the cassava used was very low (0.072 mgHCN/10 g), when compared with the maximum, which is acceptable in livestock diets (0.50 to 1,00 mg HCN/l0 g) as reported by lngram (1975) and Yo (1992). However, considering the high level of inclusion, the usual eye and respiratory tract irritation characteristic of cassava due to prussic acid (Parr, 1988), could cause the observed feed intake pattern.

Table 1: Ingredient and nutrient composition of experimental diets.

	Maize (%)	Cassayeast (%)			
Ingredients	55.00	41.11	47.94	54.79	61.64
Maize	55.00	0.00	0.00	0.00	0.00
Palm kernel cake	2.00	8.75	12.75	5.35	0.95
Soya bean meal	27.50	27.50	27.85	29.5	30.20
Wheat bran	10.79	11.57	2.25	2.00	0.00
Cassava meal	0.00	30.00	35.00	40.00	45.00
Brewers' dried yeast	0.00	11.11	12.94	14.79	16.64
Palm oil	0.87	7.28	5.40	4.60	3.60
V/M Premix †	0.25	0.25	0.25	0.25	0.25
Bone meal	2.89	2.84	2.86	2.81	2.66
D-L Methionine	0.15	0.15	0.15	0.15	0.15
Lysine	0.05	0.05	0.05	0.05	0.05
Salt	0.50	0.50	0.50	0.50	0.50
Nutrient Composition (%)					
Crude Protein (calculated)	20.07	20.12	20.12	20.12	20.08
Crude Protein (analyzed)	19.99	20.17	20.14	19.85	20.21
M/E. Kcal/kg (calculated)	2,836	2,835	2,828	2,827	2,828
Fat (calculated)	2.99	8.44	6.35	5.26	4.06
Fat (analyzed)	7.60	8.80	10.25	8.62	5.80
Crude Fibre (calculated)	4.20	4.78	5.01	4.18	2.31
Calcium (calculated)	1.06	1.10	1.05	1.08	1.04
Phosphorous (calculated)	0.64	0.64	0.66	0.67	0.64
Lysine (calculated)	1.08	1.33	1.40	1.41	1.46
Methionine (calculated)	0.40	0.49	0.42	0.48	0.50
Price of Feed/ton (₦)	247.33	219	213.08	213.92	214.25

ME: Metabolized energy

† Containing per kg Vitamin and mineral mixture: 0.15 g retinol, 25 mg cholecalciferol. 4.56 mg DL-α-tocopherol, 1 g menadione bisulphite, 3 g riboflavin, 12.5 mg nicotinic acid, 5.5 g panthothenic acid, 0.75 g pyridoxine, 0.25 g folic acid, 5 mg cobalamin. 125 g chloride, 62 g antioxidant, 12.5 g Fe, 40 g Mn, 25 g Zn, 1g Cu, 0.6 g I, 0.l g Co, 0,05 g Se.

Table 2. Performance characters of broiler chickens fed with cassayeast based diets.

	Maize (%)	Cassayeast (%)			
Parameter	55.00	41.11	47.94	54.79	61.64
Feed intake (kg)	4.50c ± 0.00	4.36b ± 0.05	4.33b ± 0.00	4.18a ± 0.21	4.21a ± 0.08
Weight gain (kg)	1.95c ± 0.03	1.78b ± 0.05	1.81b ± 0.03	1.62a ± 0.03	1.64a ± 0.07
Feed gain ratio	2.30a ± 0.54	2.45b ± 0.48	2.39b ± 0.49	2.58c ± 0.52	2.63c ± 0.58
Gain feed ratio	0.43b ± 0.11	0.41b ± 0.11	0.42b ± 0.10	0.39a ± 0.03	0.39a ± 0.13

a, b, c, means within the same row with different letters are significant ($P<0.05$)

Although, the body weight gain results showed that the birds on control diet (maize based diet) yielded the highest body weight gain, the performance of the birds in treatments B and C, which gained significantly (P<0.05) higher weights than those of treatments D and E. Indeed, the result agreed with the finding that growth rate was satisfactory when cassava meals were fed to broiler chicks (Suchmann, 1994). Similar to the findings of Pido *et* al. (1979) the growth rate, in this study, corresponded with the pattern of feed intake on all the dietary treatments.

The results of efficiency of feed utilization (feed: gain; gain: feed) showed significant (P<.05) difference between the control and the cassayeast dietary treatments in feed:gain ratio. Treatments B and C were also significantly different from D and E. It implied that there was increasing economic gain with increased maize replacement by cassayeast. Considerably, the efficiency of cassayeast based diets up to 54.79% inclusion (treatment D) was still comparable to accepted standards (Parr, 1988). Similarly, it was observed that the efficiency of feed utilization of maize based diet and 50% boiled tapioca diet was comparable (Banday and Gowdh, 1992). However, an earlier work reported normal growth rate and efficiency of feed utilization at 25 and 50% levels of cassava replacement for maize but not at 75% replacement level (Babiker *et al*. 1991). The non significant differences in the gain:feed ratio showed that the biological status of cassayeast diets B and C were similar to maize diet, but differed at inclusion levels up to 54.79 and above (Diets D and E). Considering that in previous studies cassava partially replaced maize (Pido *et al*. 1979; Babiker *et al*. 1991; Banday and Gowdh, 1992; Suchmann, 1994), the results of this study demonstrated that broiler chickens can utilize in their diets up to 30% cassava without maize, and still achieve a result comparable with that derivable from a maize soybean meal diet such as the control.

The comparable efficiency of treatments A, B and C in gain:feed ratio tended to demonstrate that the use of fortified cassava (cassayeast) to completely replace the maize portion in broiler's diets can be of practical use in the broiler industry, especially in areas where maize is scarce but cassava is available.

The results of breast weight, the organ (gizzard and liver) weights are presented in Table 3. The significant (P<0.05) breast weight results obtained in this study showed that dietary treatment B, C, D and E yielded greater breast muscle than the control. This finding was based on the percent of body weight, the conventionally accepted method of expressing tissues/organ weights. Considering that breast muscle weight is a representative of body protein (Wilen and Naftolin, 1978), the results of this study demonstrated that cassayeast was superior to maize in the formation of broiler body protein. The superiority of cassayeast could probably be due to its yeast component, which is a single cell protein, because it has been found that the amino acid profile of single cell protein is more balanced than that of the grains (Ensminger and Olentine, 1978). Moreover, the unidentified growth factors (UGF) in BDY may have potentiated the observed enlarged breast muscle weight in this study (Potter and Shelton, 1978).

The results of mean gizzard weights showed no significance difference (P>.05) in this study. Patrick and Schaible (1980) stated that the size and the strength of the gizzards are related to the hardness of the feed particles and the presence of crushed insoluble stones (grit). Considering that gizzards are organs for crushing and mixing feed with water (Say, 1987), and since their sizes were not affected by the dietary treatments, it implied that cassayeast posed no digestive problem in the course of its utilization by the broiler chickens. These findings supported previous reports that, cassava having a high content of useable carbohydrate, with low fibre, provided a good potential energy source for non-ruminant animals (Creswell, 1978).

Table 3: Effects of cassayeast based diets on the breast and organ weights of broilers.

	Maize (%)	Cassayeast (%)			
Parameters	55.00	41.11	47.94	54.79	61.64
Breast weight (g)	15.71a ± 2.83	16.93b ± 1.75	16.58b ± 0.93	16.35b ± 2.17	17.25a ± 2.00
Gizzard weight (g)	3.65a ± 0.72	3.70a ± 0.78	3.68a ± 0.07	3.72a ± 1.44	3.76a ± 0.53
Liver weight (g)	0.94a ± 0.27	1.09b ± 0.03	1.21c ± 0.31	1.52d ± 0.27	1.67e ± 0.08

[a, b, c] Means within the same row with different superscripts are significant (P<O.05)

The result of the liver showed a spectacular pattern of significant difference among the dietary treatments. It was found that, liver weights increased as the cassayeast increased. Considering that fat in form dietary palm oil was added to all the diets, to balance the diets to be isocaloric and reduce dustiness of the cassava meal, the observed pattern of significant difference (P<.05) in liver weight was most likely not due to fat metabolism, higher liver weight is usually associated with higher detoxification activity. Contrary to this, feeding high dietary fat increased fatty acid oxidation in the liver, and thus resulting in reduced liver weights (Daggy *et al*. 1987). Accordingly, it appeared that the increased liver weights were more associated with the increased cassayeast, and it may specifically be cassava having 80% starch and 20% sugar of its 32.8% NFE (Vogt, 1966). Obviously it may not be BDY, *per se*, which contains UGF that enhances the clearance of liver of fatty deposits (Jensen *et al*. 1976).

The result of the liver weights tended to suggest that the avian liver may be ineffective in cassava metabolism when compared with maize, and that this ineffectiveness may have occurred because the liver was unable to efficiently detoxify the HCN and metabolize the quantity of starch in cassava simultaneously.

The results showed that at optimum inclusion, up to. 47.94% cassayeast (35% CM) can completely replace maize in a practical broiler diet with efficiency comparable to that of a maize-soybean meal diet. This study, therefore, recommends the use of protein fortified cassava such as cassayeast to completely replace maize in broiler diets in areas where the cost of cassava is substantially cheaper than maize.

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