

COMPARATIVE EVALUATION OF RAW AND UREA/TOASTED VELVET BEAN (*Mucuna pruriens*) FOR BROILER CHICKS

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ABSTRACT

Feeding trials lasting 28 days were conducted to investigate the nutritive value of raw and urea treated/toasted mucuna bean for broiler chicks. Raw mucuna bean contains 30.33% crude protein, 7.20% crude fibre, 6.9% ether extract and 5.0% ash. Mucuna bean seeds were divided into two batches. One batch was ground raw and the other batch was ground raw, treated with 3% of its weight of urea and toasted. Mucuna bean meals so produced were then used to formulate broiler chick diets incorporating these meals at 5% and 10% respectively. One hundred and fifty (150), 7-day-old Anak broiler chicks were randomly assigned to the five dietary treatments in a completely randomized design (CRD) and each treatment group was further sub-divided into three replicates.

Feed intake of the birds was inconsistent with the treatments, increasing at 5% inclusion level and decreasing at 10% inclusion level ($P < 0.05$). Body weight gain of the birds followed the same pattern as feed intake, decreasing at a higher dietary level of mucuna bean meal. The decrease became significant ($P < 0.05$) also at 10% dietary level. Dietary inclusion of mucuna bean meal at all levels reduced cost of feed and meat production.

The results of this trial suggest that broiler chicks could not tolerate raw mucuna bean meal beyond 5% dietary level. Urea treatment at this level (3% of the weight of mucuna bean) and toasting did not improve the nutritive value of mucuna bean beyond 5% dietary level.

Keywords: Raw velvet bean, urea toasted velvet bean, broiler chicks, evaluation.

INTRODUCTION

The problem of malnutrition, particularly protein malnutrition is real in most developing countries of the world. These countries are mostly located in the warm humid tropics where the level of animal protein intake represents about one-tenth of the level of intake in advanced countries. The high cost of feed in various tropical countries vividly indicate that the production of cereal grains for livestock business in these countries is grossly inadequate.

Furthermore, the competition for the available grain between humans and animals had resulted in the near collapse of poultry industry in Nigeria. Currently groundnut (*Arachis hypogea*) and soybean (*Glycine max*) play important roles in the feeding of non-ruminant animals in the country (Esonu, 1996). However, due to the unavailability of these grains, coupled with the high cost of imported ingredients, the price of commercial feed has increased over 3000% (Udedibie, *et al.*, 1994). This resulted in the liquidation of about 30% of the feedmills while the few in production, produce at below capacity levels.

A tropical legume such as velvet bean (*Mucuna pruriens*) is a potential feed supplement. It is not directly consumed by humans in this country and it is known for its high seed and foliage yield. The mucuna bean seed contains moderate percentage of crude protein and high in fatty acids (Moglis *et al.*, 1978) with small amount of metabolisable energy (Emenalom, 1996).

TABLE 1: PROXIMATE COMPOSITION AND GROSS ENERGY OF RAW AND UREA TREATED/TOASTED MUCUNA BEAN MEAL

| Component (% of DM) | Raw | Urea treated/toasted |
|----------------------|-------|----------------------|
| Moisture content | 12.80 | 3.11 |
| Dry matter | 87.20 | 96.89 |
| Crude protein | 30.33 | 36.75 |
| Crude Fibre | 7.20 | 4.25 |
| Ether Extract | 6.95 | 5.55 |
| Ash | 5.00 | 4.50 |
| Gross Energy (MJ/kg) | 17.1 | ND |

ND = Not determined.

However, like other tropical legumes, mucuna contains anti-nutritional factors which limit its use in animal feeding. Raw mucuna seeds contain high levels of anti-trypsin activity, phytate, cyanide and tannins (Ravindran and Ravindran, 1988; Olaboro *et al.*, 1991). The objective of this study therefore was to determine the efficacy of dry urea treatment prior to toasting on the nutritive value of mucuna bean compared with the nutritive value of the raw bean on broiler chicks.

MATERIALS AND METHODS

Source and processing of the seed

Velvet beans (*Mucuna pruriens*) used for this study were harvested from the University teaching and research farm. The mucuna bean seeds were ground raw in a milling machine and sieved with 350 sieve to remove the testa. It was divided into two batches, the first batch was left raw but the other batch was treated with 3% of its weight of urea and left to stand for 2 days and later subjected to local toasting at a temperature fluctuating between 80 and 100°C, until it became crispy.

The toasting which lasted for 15-20 minutes involved adding about one kilogramme of the meal into a pan already placed on a gas cooker and steadily turning it until it became crispy and dark yellow in colour. Samples of the raw and urea treated/toasted mucuna bean meals were analyzed for their proximate composition (AOAC, 1980). (Table 1).

Experimental Diets:

Five (5) experimental diets were formulated such that the control diet (0%) contained no Mucuna bean, diet 2 contained 5% raw Mucuna bean (RMB), diet 3 contained 10% raw mucuna bean (RMB), diet 4 contained 5% urea/toasted mucuna bean (UTMB) and diet 5 contained 10% urea/toasted mucuna bean (UTMB) (Table 2).

Experimental Birds and Statistical

Analysis:

One hundred and fifty (150), 7-day-old Anak broiler chicks were randomly assigned to the five dietary treatments in a completely randomized design (CRD). Each treatment group of 30 birds was further subdivided into three replicates of 10 birds and kept in a compartment measuring 2 x 4m. Individual weights of the birds were recorded at the beginning of the trial. Feed and water were provided *ad-libitum*. Feed intake was recorded daily while the birds were weighed weekly. The trial lasted for 28 days.

Data on feed intake, body weight gain and feed conversion ratio of the treatment groups were subjected to analysis of variance as outlined by Snedecor and Cochran (1978). When analysis of variance indicated significant treatment effects, specific differences between means detected by Duncan's New Multiple Range Test (DNMRT) as outlined by Obi (1990).

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TABLE 2: COMPOSITION OF THE EXPERIMENTAL DIETS

| Ingredients | 0 | 5(RMB) ³ | 10(RMB) | 5(UTMB) | 10(UTMB) ³ |
|--|-------|---------------------|---------|---------|-----------------------|
| Maize | 55.0 | 55.0 | 55.0 | 55.0 | 55.0 |
| Groundnut | 20.0 | 15.0 | 10.0 | 15.0 | 10.0 |
| Mucuna bean meal | 0.0 | 5.0 | 10.0 | 5.0 | 10.0 |
| Palm Kernel meal | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Fish meal | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Brewers dried grain | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Wheat offal | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 |
| Blood meal | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Bone meal | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| Vit/TM premix ¹ | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Salt | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Lysine | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Methionine | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Chemical Composition (% of DM): | | | | | |
| Crude protein | 22.61 | 22.61 | 22.92 | 22.57 | 22.95 |
| Crude fibre | 3.95 | 4.21 | 4.47 | 4.06 | 4.16 |
| Ether Extract | 4.40 | 5.43 | 5.58 | 5.36 | 5.44 |
| Calcium | 1.34 | 1.28 | 1.28 | 1.27 | 1.28 |
| Phosphorus | 0.72 | 0.63 | 0.64 | 0.66 | 0.65 |
| Lysine ² | 0.75 | 0.76 | 0.75 | 0.75 | 0.75 |
| Methionine ² | 0.43 | 0.41 | 0.42 | 0.43 | 0.42 |
| ME (MJ/kg) ² | 11.80 | 11.76 | 11.84 | 11.76 | 11.76 |

¹To provide the following per kg of feed:

Vitamin A, 10,000.000 IU; Vitamin D₃, 2,000.00 IU; Vitamin B₁, 0.75g; Vitamin B₂, 5g; Nicotinic acid, 25g; Calcium pantothenate, 12.5g; Vitamin B₁₂, 0.015g; Vitamin K₃, 2.5g; Vitamin E, 25g; Biotin, 0.050g; Folic acid, 1mg; Choline chloride, 250g; Cobalt, 0.400g; Copper, 8g; Manganese, 64g; Iron, 32g; Zn, 40g; Iodine, 0.8g; Flavomycin, 100g; Sprianycin, 5g; 3-Nitro, 50g; DL, methionine, 50g; Selenium, 0.16g; L-Lysine, 120g; BHT, 5g.

²Calculated values

³RMB, Raw Mucuna Bean

³UTMB, Urea Treated/Toasted Mucuna Bean.

RESULTS AND DISCUSSION

The chemical composition of both raw and urea/toasted mucuna bean meal is shown in Table 1 and the performance of the birds shown in Table 3. The proximate composition of mucuna beans shows that, the raw bean contained 30.33% crude protein, 7.20% crude fibre, 6.95% ether extract and 5.0% ash.

Feed intake of the birds was inconsistent with the treatments, increasing at 5% inclusion level (RMB and UTMB) and decreasing at 10% dietary level (RMB and UTMB). This decrease which was however significant ($P < 0.05$) at 10% level of inclusion of RMB and UTMB was probably due to the effect of the anti-nutritional factors.

TABLE 3: EFFECT OF RAW AND UREA/TREATED-TOASTED VELVET BEAN ON THE PERFORMANCE OF YOUNG BROILER CHICKS

| Measurements | Dietary levels of velvet bean (%) | | | | | SEM |
|--|-----------------------------------|--------------------|--------------------|--------------------|--------------------|-------|
| | Control 0% | 5% RMB | 10% RMB | 5% UTMB | 10% UTMB | |
| Initial body wt (g) | 100.00 | 100.010 | 100.15 | 100.13 | 100.10 | 0.02 |
| Final body wt (g) | 945.0 ^a | 900.0 ^a | 800.0 ^b | 900.0 ^a | 800.0 ^b | 30.01 |
| Body wt gain (g) | 846.0 ^a | 800.0 ^a | 700.0 ^b | 800.0 ^a | 700.0 ^b | 36.21 |
| Daily body wt gain (g) | 30.21 ^a | 28.57 ^a | 25.0 ^b | 28.57 ^a | 25.00 ^b | 3.24 |
| Daily feed intake (g) | 82.07 ^a | 73.43 ^a | 64.98 ^b | 75.67 ^a | 71.73 ^a | 2.03 |
| Feed conversion ratio (g feed/g gain) | 2.72 | 2.57 | 2.6 | 2.65 | 2.87 | 0.20 |
| Feed cost (₦/kg) | 50.85 | 49.07 | 48.61 | 49.67 | 48.58 | - |
| ₦/kg meat produced | 138.31 | 126.10 | 126.39 | 131.63 | 139.42 | - |
| Feed cost saving (%) | - | 3.50 | 4.41 | 2.32 | 4.46 | - |

^{ab} Mean within rows with different superscripts are significantly different ($P < 0.05$).

(-) Not applicable

The body weight gain of the birds also followed same trend as feed intake, decreasing at higher dietary levels. This decrease became significant ($P < 0.05$) at 10% dietary level (RMB and UTMB). There was no significant difference ($P > 0.05$) in feed conversion ratio among the treatment groups. The group on 5% RMB recorded the best feed conversion ratio numerically, followed by the group on 10% (RMB) while birds on 10% (UTMB) recorded the poorest feed conversion ratio. Feed cost in term of (₦/kg) stood at 50.85, 49.07, 48.61, 49.67 and 48.58, for 0%, 5% RMB, 10% RMB and 5% UTMB respectively. In other words, dietary inclusion of mucuna bean meal at all levels reduced feed cost. Feed cost savings (%) were 3.50, 4.41, 2.32 and 4.46 for 5% RMB, 10% RMB, 5% UTMB and 10% UTMB respectively.

Toasting/urea treatment seemed to concentrate the nitrogenous compounds in the bean by removing much of the water molecules, and increasing the nitrogen content, thus increasing its crude protein content. A similar observation was reported by Udedibie *et al.* (1994) on toasted/urea treated jackbean meals.

The exact mode of action of urea on the anti-nutritional factors in the Mucuna bean is not clear. Urea is a very strong protein denaturing agent and can achieve this by competing for hydrogen bond with the peptide backbone thereby breaking up the secondary structure of the native proteins and disrupting their biologically active structures (Rawn-David, 1983). Mucuna bean is known to contain some trypsin inhibitors, tannins, hydrocyanic acid, phytic acid, phosphate and other anti-nutritional factors (Ravindran and Ravindran, 1988). These interfere with the biological utilization of the protein and to a lesser extent of available carbohydrates and lipids (Moseley and Griffiths, 1979). The most common inhibitor in legumes act on serine protease, a group of proteolytic enzymes which includes trypsin and chymotrypsin (Puszatai, 1977).

Serine protease inhibitors are proteins that form very stable complexes with the digestive enzymes reducing their activity to very low levels. The poor digestibility of food legume proteins is due to residual proteinase inhibitors not affected by heat or to reaction between the proteins and compounds such as Polyphenols or to the tertiary structures of protein bodies which prevent proteolytic enzymes from

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acting effectively (Tobin and Carpenter, 1978). However, some of the anti-nutritional factors can readily be eliminated or inactivated by boiling (Emenalom, 1996) and potential toxicants remain relatively innocuous until they are acted upon by enzymes of endogenous origin (Ravindran and Ravindran, 1988; Bender, 1970). The results of this trial showed that toasting/urea treatment could not improve the nutritive value of mucuna bean for broilers beyond 5% inclusion level. It was inter-disciplinary approach to investigations for improving the nutritive value of mucuna

postulated that urea treatment combined with toasting would have improved the nutritive value of mucuna bean beyond 5% dietary level. This result agreed with the findings of Olaboro *et al.* (1991), that Velvet bean fed to broilers depressed growth rate. Dietary inclusion of mucuna bean at all levels reduced feed cost which was also reflected in the feed cost savings (%), but the ₦/kg meat produced values were inconsistent with the dietary levels of mucuna bean. There is need therefore for bean for livestock, particularly for non-ruminant animals.

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