**FULL PAPER**

Sokoto Journal of Veterinary Sciences
(ISSN 1595-093X)
Abubakar & Ohiaege. /*Sokoto Journal of Veterinary Sciences* (2011). 9(2):16-19.

# Replacement value of cassava peels for maize in the diets of broiler finisher chickens

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**Abstract**
A study was conducted to investigate the effects of replacing maize (MZ) with cassava peels (CSP) on the performance characteristics of broiler finisher. Five diets were formulated where MZ was replaced with CSP. The diets were diet 1 (100% MZ : 0% CSP), diet 2 (75% MZ : 25% CSP), diet 3 (50% MZ : 50% CSP) diet 4 (25% MZ : 75% CSP) and diet 5 (0% MZ : 100% CSP). Diet 1 served as control treatment. A total of 150 birds were used for the experiment. Thirty birds were assigned to each treatment and each treatment replicated three times with ten birds per replicate. The birds ( *arbor acre* strain) were fed *ad libitum* for 28 days. Data on feed consumption, daily weight gain, feed conversion ratio, nutrient retention, water intake and cost benefit ratio were recorded. Results showed that average feed intake (AFI) and body weight gain (BWG) were significantly higher ($P<0.05$) for birds fed diet 3. Feed conversion rat io (FCR), nutrient retention and cost of feed consumed/bird decreased as CSP level increased. Water intake showed no significant difference ($P>0.05$) among birds for all treatments. The cost per kilogram live weight gain was lower ($P<0.5$) for birds fed diet 3. Cost-benefit ratio showed a reduction of 20.6% in the cost of production of birds fed diet 3 over that of control group. Average mortality of 6.67 % was recorded for birds fed diets 1, 3 and 5. It was concluded that CSP can replace MZ without any adverse effects on the performance characteristics of finisher broilers.

*Keywords*: broiler finisher, cassava peels, cost-benefit, maize replacement value.

## Introduction

Broiler birds tend to consume large quantity of feed with increase in age especially at the finisher stage and thus their diet demands the use of large quantities of ingredients especially energy yielding ingredients. Maize is one of the most popular and commonly used ingredients in the diets of poultry. The cost of this ingredient has increased drastically due to competition between man and his livestock, problems associated with weather fluctuation, and money devaluation (Tewe, 2004). To this end, there is need to exploit the use of potential feedstuff and agro-industrial by-products such as cassava peels that are abundant in Nigeria for inclusion in the diet of poultry. Hahn (1988) reported that about 4 – 6 tons of CSP is produced in the country annually. Cassava peel constitutes 11-12% of total cassava root. Its chemical and proximate composition reveal high gross energy value of (3810 kcal/kgME), low protein (4.0%), digestible fat (0.9%), crude fiber (4.7%), ash (1.9%), and nitrogen free extract (88.5%) that could be efficiently utilized by poultry (Obioha, 1992). However, the CSP contains high levels of hydrogen cyanide and high fiber which is the most limiting factors restricting its use in the diets of poultry. On the other hand, adequate processing methods such as sun drying and inclusion of additives such as methionine, cystine and Roxazyme-G enzyme in the diets have been reported to enhance its utilization (Bashar, 1997; Ohiaege, 1999; Ojo & Deane, 2002).

## Materials and methods

*Study area*

The study was conducted at the Poultry Production Unit of the Department of Animal Science Teaching and Research Farm, Usmanu Danfodiyo University, Sokoto. Sokoto State is located in the Sudan Savannah zone in the extreme north western part of Nigeria, between Longitudes $4^0$ 8' and $6^0$ 54'E and Latitude $12^0$ 0' and $13^0$ 58'N (Mamman *et al.,* 2000). The State has a semi-arid climate, which is characterized by low rainfall of 750mm, potential evapo-transpiration rate of 162cm and long dry season from January to May and sometimes June (SSMIYSC, 2001). The average annual temperature is $34.9^0$C, with the highest temperature ($41^0$C) occurring in April and lowest temperature of $13.2^0$C in January (Mamman & Udo, 1993).

*Management of experimental birds*

One hundred and fifty (150) four weeks old broiler birds were randomly assigned to five dietary treatments D1, D2, D3, D4, and D5 with 30 birds per treatment and

each treatment was replicated three times with 10 birds per replicate. Diet 1 served as the control treatment. Diets and water were fed *ad libitum* to the chicks for 28 days between the hours of 8.00am and 9.00am.

*Preparation of experimental diets*

The cassava peels (MR-8083) were obtained from Mange village of Tambuwal local government area of Sokoto state. The cassava peels were sun-dried for 10 days and spread in an open room with good air circulation for 20 days. The sundried CSP was used for feed formulation. The yellow maize, wheat offal, groundnut cake, soybean meal, fishmeal, salt and groundnut oil were purchased from Sokoto Central Market. Bone meal and blood meal were obtained from Sokoto Central Abattoir, while vitamin premix, methionine and lysine were obtained from reliable poultry and allied products company in Ibadan with their office in Sokoto. Five diets were formulated with cassava peels (CSP) and maize (MZ) replaced at levels 0, 25, 50, 75 and 100 % (for Diets 1,2,3,4 and 5) respectively. Diet 1 with 0 % CSP served as the control diet. The diets were iso-nitrogenous and iso-caloric in composition. The gross, calculated and analyzed chemical compositions of the experimental diets are shown in Table 1.

**Table 1:** Composition of the finisher diets

| | Levels of replacement of maize with cassava peel (%) | | | | |
|---|---|---|---|---|---|
| Ingredients | 0 | 25 | 50 | 75 | 100 |
| Maize | 54.00 | 40.50 | 27.00 | 13.50 | 0.00 |
| Cassava peels | 0.00 | 13.50 | 27.00 | 40.50 | 54.00 |
| Wheat offal | 9.20 | 8.20 | 7.05 | 5.55 | 4.20 |
| Groundnut cake | 22.22 | 24.10 | 26.05 | 27.95 | 29.80 |
| Groundnut oil | 2.60 | 1.70 | 0.90 | 0.50 | 0.00 |
| Others* | 12 | 12 | 12 | 12 | 12 |
| Total | 100 | 100 | 100 | 100 | 100 |
| Calculated analysis | | | | | |
| Crude protein (g $kg^{-1}$) | 20.02 | 20.12 | 20.23 | 20.27 | 20.31 |
| ME (Kcal $kg^{-1}$) | 3005 | 3011 | 3020 | 3046 | 3067 |
| Crude protein (g $kg^{-1}$) | 22.03 | 22.63 | 20.21 | 21.75 | 21.41 |
| Crude fibre (g $kg^{-1}$) | 3.00 | 3.75 | 4.65 | 5.81 | 6.97 |
| Ether extract (g $kg^{-1}$) | 3.00 | 2.50 | 2.50 | 2.50 | 2.00 |
| Cost/kg (N)** | 43.29 | 40.33 | 38.68 | 37.93 | 34.38 |

* Vitamin premix (1.0g $kg^{-1}$), blood meal (5.0 g $kg^{-1}$), bone meal (4.0g $kg^{-1}$), methionine (0.5g $kg^{-1}$), Lysine (0.5g $kg^{-1}$), salt (1.0 g $kg^{-1}$)

**Feed cost per kg was calculated on the basis of prevailing market prices of ingredients as at the time of experiment.

*Nutrient retention trial*

At the end of the feeding trial, nutrient retention trial was conducted using 3 birds from each replicate. The birds were fed their respective experimental diets. The trial lasted for 7 days, with 3 days for adaptation and 4 days of feacal collection. During the period, records of daily feed intake were kept. Total faecal output from each animal was recorded daily and 20grams of each sample of the five experimental diets and faecal samples were oven dried at 80$^{o}$C and analyzed for proximate composition as outlined by AOAC (1990).

*Data collection*

Daily records of feed intake were taken throughout the 28 days by weighing the feed offered in the morning and the stale feed (left over) the following day in the morning, before offering the next feed. Mortality record was recorded as it occurs; body weight was recorded on weekly basis while feed conversion ratio was calculated from the records of feed intake and body weight gain. The trial was terminated at the age of eight week.

*Experimental Design and Statistical Analysis*

The experimental design was a completely randomized design (CRD) and data generated were subjected to analysis of variance (ANOVA) using SPSS (1999) package. Means separation was done by Duncan's New Multiple Range Test (DNMRT) following the procedure outlined by Steel & Torrie (1980).

**Results and discussion**

Results of the performance characteristics of broiler finishers are shown in table 2. The final body weights showed significant difference among treatment diets. Birds fed diet 3 recorded the highest ($p<0.05$) final body weight of 1,683.3g, while birds fed diet 5 recorded the least final body weight of 1,270.0g. Birds on treatments 1, 2 and 4 had similar final body weight ($p>0.05$). The body weight gain of the birds followed the same pattern. Water intake per bird showed no sign ificant difference ($p>0.05$) for birds on all treatment diets. Total feed intake of birds on all treatment diets was similar ($p>0.05$). Broiler birds are known to eat more when diets are palatable and coarse than when finely ground and unpalatable (Leeson, 2000) Feed conversion ratio

was similar (p>0.05) for birds on diets 1, 2, 3, and 4 while birds on diet 5 recorded a significantly (p<0.05) higher FCR (2.77) compared to birds on diets 1, 2, and 3. This could be due to high level of crude fiber content of the diet which might have reduced the digestibility of

**Table 2**: Performance characteristics of broiler finisher birds

| | Levels of replacement of maize with cassava peel (%) | | | | | |
|---|---|---|---|---|---|---|
| Parameters (average/bird) | 0 | 25 | 50 | 75 | 100 | SE ± |
| Initial weight (g/b) | 590.3 | 590.6 | 590.4 | 590.3 | 590.3 | 6.14 |
| Final weight (g/b) | 1510.0$^{bc}$ | 1423.3$^{ab}$ | 1683.3$^{c}$ | 1320.0$^{ab}$ | 1270.0$^{a}$ | 65.20 |
| Body weight gain (g/b) | 920.0$^{bc}$ | 833.3$^{ab}$ | 1093.3$^{c}$ | 730.0$^{ab}$ | 680.0$^{a}$ | 62.94 |
| Total feed intake/bird (g/b) | 1603.3 | 1640.0 | 1956.6 | 1496.6 | 1870.0 | 181.18 |
| FCR | 1.72$^{a}$ | 1.97$^{a}$ | 1.81$^{a}$ | 2.14$^{ab}$ | 2.77$^{b}$ | 0.21 |
| Total water intake/bird (ml) | 6718.0 | 7059.6 | 7339.8 | 6693.8 | 6905.8 | 657.82 |
| Mortality (%) | 6.67$^{a}$ | 0.00$^{b}$ | 6.67$^{a}$ | 0.00$^{b}$ | 6.67$^{a}$ | 6.02 |

a, b, c. means not followed by same letters along the same row are significantly different (p<0.05).

nutrients. Oyebimbe *et al.* (2006) reported that high fiber diets usually tend to inhibit protein utilization at high inclusion levels, leading to low FCR and body weight gain. Mortality of birds did not differ significantly (p>0.05) for birds on diets 1, 3, and 5. However, the values were significantly higher (p<0.05) than those recorded for birds on diets 2 and 4.

*Cost-benefit analysis*

Table 3 showed the cost of feed (₦/kg) to progressively decrease from ₦43.29 in diet 1 down to ₦34.38 in diet 5 even though not significant. The percentage cost reduction increased as cassava peels concentration increased from 0% for diet 1 to 20.60% for diet 5. Cost of feed consumed per bird showed no significant difference among all the treatment diets. The cost of feed per kg live weight gain (₦94.50/kg) was significantly higher (P<0.05) for birds fed diet 5 and lower (P<0.05) for those fed diet 3 (₦69.20/kg). This showed that more meat could be obtained at less cost for using diet 3. However, an inclusion of cassava peels up to 75% showed no adverse effect on the performance of broiler finishers and could lead to greater reduction in cost.

*Apparent nutrient retention*

Table 4 shows the results of the nutrient retention. From the results, birds fed diets, 1, 2, 3 and 4 were similar (p>0.05) for dry matter retention. However, those on treatments 1 and 5 recorded significantly (p<0.05) different dry matter retention with control birds having better retention. The CP and CF retention followed similar pattern with the DM, while EE and Ash retention of birds were not affected by the levels of CSP. Soluble carbohydrate and NFE followed similar pattern with CP and CF.

**Table 3**: Cost-benefit analysis

| | Levels of replacement of maize with cassava peel (%) | | | | | |
|---|---|---|---|---|---|---|
| Parameters | 0 | 25 | 50 | 75 | 100 | SE ± |
| Cost of fed (₦/kg) | 43.29 | 40.33 | 38.68 | 37.93 | 34.38 | |
| Cost reduction (%) | 0.00 | 6.80 | 10.60 | 12.40 | 20.60 | |
| Cost of Feed Consumed/bird (₦) | 69.44 | 66.14 | 75.66 | 56.74 | 64.26 | 7.01 |
| Feed Cost/kg weight gain (₦/kg) | 75.48$^{c}$ | 79.37$^{c}$ | 69.20$^{a}$ | 77.73$^{bc}$ | 94.50$^{d}$ | 1.24 |

a, b, c. means not followed by same letters along the same row are significantly different (p<0.05).

**Table 4**: Apparent nutrient retention of broiler finishers

| | Levels of replacement of maize with cassava peel (%) | | | | | |
|---|---|---|---|---|---|---|
| Nutrient retention (%) | 0 | 25 | 50 | 75 | 100 | SE ± |
| DM | 71.86$^{b}$ | 53.49$^{ab}$ | 57.81$^{ab}$ | 66.39$^{ab}$ | 45.07$^{a}$ | 6.38 |
| CP | 74.96$^{b}$ | 62.05$^{ab}$ | 61.24$^{ab}$ | 71.15$^{ab}$ | 53.30$^{a}$ | 5.65 |
| CF | 81.77$^{c}$ | 76.41$^{bc}$ | 67.97$^{bc}$ | 54.39$^{abc}$ | 47.48$^{ab}$ | 8.84 |
| EE | 72.40 | 63.03 | 91.56 | 82.40 | 66.56 | 9.46 |
| ASH | 68.64 | 57.36 | 61.62 | 45.82 | 48.85 | 6.42 |
| NFE | 75.54$^{b}$ | 73.94$^{b}$ | 61.26$^{ab}$ | 61.27$^{ab}$ | 52.83$^{a}$ | 5.62 |

a, b, c. means not followed by same letters along the same row are significantly different (p<0.05).

The performance parameters revealed that cassava peels could be satisfactorily included in broiler ration without any negative effects on the performance but could affect the retention of DM, CP, and CF at higher levels of inclusion. Birds could also be raised at cheaper rate if cassava peels replace up to 50% of maize.

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