ISSN 1682-8356
ansinet.org/ijps

# INTERNATIONAL JOURNAL OF POULTRY SCIENCE

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

International Journal of Poultry Science 9 (4): 363-367, 2010
ISSN 1682-8356


# Effect of Moringa (*Moringa oleifera*) Inclusion in Cassava Based Diets Fed to Broiler Chickens

T.S. Olugbemi[1], S.K. Mutayoba[2] and F.P. Lekule[2]
[1]Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University, Zaria, Nigeria
[2]Department of Animal Science and Production, Sokoine University of Agriculture, P.O. Box 3004, Morogoro, Tanzania

**Abstract:** The suitability of including *Moringa oleifera* leaf meal (MOLM) as a feed ingredient in cassava (CC) based broiler diets was evaluated. Seven isonitrogenous and isocaloric diets represented as treatments 1 (maize meal based-control), 2, 3, 4 (20% CC and 0, 5, 10% MOLM) and 5, 6, 7 (30% CC and 0, 5, 10% MOLM) were fed to 378 broiler chicks for 49 days in a completely randomized design. Parameters measured were weight, weight gains, final weight and feed consumed. Feed conversion ratio and feed cost per kilogram weight gain were calculated. Haematological parameters were also obtained after the 49 day trial. A reduction in performance was observed with increasing inclusion level of MOLM beyond 5%. Birds on treatment 3 (20% CC, 5% MOLM) did not differ significantly (p>0.05) in terms of weight gain (2263.62-2428.26 gm), feed conversion ratio (2.57-2.81), final body weight at 8 weeks (2342.09-2501.24 gm) and feed cost per kilogram weight gain (979.38-1075.78 TSH) from those on the control, 20 and 30% diets (treatments 1, 2, 5). The highest feed consumption (6390.7gm) was recorded among birds on treatment 3 but did not significantly differ (p>0.05) from those on treatments 1, 2, 6 and 7(6002.7-6346.9 gm). It was concluded that broilers could be safely fed cassava based diets containing MOLM at a maximum level of 5% without deleterious effects.

**Key words:** *Moringa oleifera*, leaf meal, cassava chips, broiler, utilization

## INTRODUCTION

Chickens constitute one of the most commonly eaten animal species in developed countries but this isn't the case in developing countries mostly due to the cost which is beyond the reach of the common man. The WHO recommended animal protein intake of 60gm per day is hardly met. Feed cost accounts for up to 80% of the total cost of production and is a very important component in determining the extent of poultry survival and profitability.

Maize has traditionally been the ingredient of choice for the supply of energy in monogastric animal diets with inclusion levels from 50-70% (PAN, 1995). Its important role as a human and industrial food ingredient coupled with drought in some parts of Africa has sometimes caused relative scarcity of the ingredient and an attendant increase in price invariably leading to an increase in feed costs. These amongst other factors have prompted the need to discover or re-discover other potential energy sources which are either not consumed by humans, not in relative high demand or resistant to drought.

One of such is cassava (*Manihot esculentus*) also known as tapioca, manioc, mandioca or yucca. Cassava is widely grown in most areas of Tanzania mostly by smallholder farmers and with an arable land occupation of 1-3 million hectares producing 6.8 million tons/annum and a yield of 2.6 tons/hectare (MDB, 1998; FAO, 2000). Limitations to the use of cassava in animal feeds amongst others are its relatively low protein content particularly with respect to the essential amino acids and dustiness.

Numerous options have continually been advocated to alleviate these problems. These have included the inclusion of synthetic amino acids, supplementing with richer protein sources such as seed, cakes or leafs and utilization of cassava in various forms apart from powder. Cassava chips are popular in cattle and other livestock feeds but there is a dearth of information in chip utilization in broiler feeds. Most studies have been on the utilization of either the roots or leaf meal in broiler diets. The form of cassava feeding is important in the performance of birds (Tewe and Bokanga, 2001). A natural source of protein with great potential is *Moringa oleifera*, which apart from its medical uses is a good source of vitamins and amino acids. The utilization of chips could solve the problem of dustiness while some of the nutritional deficiencies could be alleviated with Moringa inclusion thereby enhancing the utilization of cassava and the easy adoption by the common poultry farmer. Therefore the objectives of the present study were to determine the optimum level of MOLM inclusion in cassava based broiler diets and its effect on haematological parameters.

**Corresponding Author:** T.S. Olugbemi, Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University, Zaria, Nigeria

## MATERIALS AND METHODS

**Source and production of MOLM and CC:** *Moringa oleifera* leaves were harvested from an orchard within the premises of the Department of Animal Science and Production farm unit, Sokoine University of Agriculture, Morogoro, Tanzania. The cut branches were spread out on a concrete floor and allowed to dry for a period of 3-4 days under shady conditions after which the leaves were separated from the twigs before milling in a hammer mill to produce the leaf meal. The cassava chips were obtained from farmers in Kibaha district of Tanzania.

**Biochemical analysis:** Samples of the MOLM and CC were subjected to proximate analysis according to AOAC (1990) methods (Table 1). The proximate composition of other feed ingredients used in formulating the diets was also determined as above.

Table 1: Proximate composition of MOLM and CC

| Nutrients/Parameters | MOLM | CC |
|---|---|---|
| DM (%) | 93.70 | 92.28 |
| Crude protein (%) | 27.44 | 5.13 |
| Crude fibre (%) | 9.13 | 4.05 |
| Ether extract (%) | 6.3 | 1.5 |
| Ash (%) | 11.42 | 6.1 |
| Nitrogen free extract (%) | 45.71 | 83.22 |
| ME kcal/kg | 2978 | 3279 |
| Calcium (%) | 1.42 | 0.13 |
| Phosphorus (%) | 0.35 | 0.13 |

**Experimental diets:** Seven isonitrogenous and isocaloric experimental broiler diets were formulated to obtain MOLM and CC combinations as follows: diet 1(0% MOLM, 0%CC), 2(0% MOLM, 20%CC), 3(5% MOLM, 20%CC), 4(10% MOLM, 20%CC), 5(0% MOLM, 30%CC), 6(5% MOLM, 30%CC), 7(10% MOLM, 30%CC) (Table 2).

**Management of birds:** Three hundred and seventy eight day old Abroacre broiler chicks were initially brooded together for one week and subsequently divided into 3 groups of 54 chicks each and randomly allocated to one of 7 treatments in a Completely Randomized Design (CRD). Each treatment comprised of 3 replicates with 18 chicks per replicate kept on floor pens. Feed and water were provided *ad libitum and* all medications and required managerial practices applied as at when due. Daily feed intake and individual weekly bird weights were recorded during the 56 day experimental period. Weekly weight gains and Feed conversion ratio were calculated.

**Haematological evaluation:** Blood samples were obtained from three birds per replicate making a total of nine per treatment at the eighth week by inserting a new sterile needle into the wing vein of the birds and extracting 2 mls of blood which was placed inside sterile test tubes containing Ethylene Diamine Tetra Acetic Acid (EDTA). The blood samples were properly shaken to mix with the EDTA in order to prevent coagulation. The samples were then analyzed for Red Blood Cells (RBC), Packed Cell Volume (PCV), Haemoglobin (Hb) and White Blood Cells (WBC) as well as differential count (Heterophil, Lymphocyte, Eosinophil, Monocyte and Basophil). The PCV was determined using a haematocrit with 75 x 16 mm capillary tubes filled with blood and centrifuged at 3000 r.p.m. for 5 min. RBC-erythrocyte count was done with an improved Neubauer chamber using formal citrate as a diluent to obtain a 1:20 blood dilution and Hb was calculated. WBC was determined using the Bulk dilution method. The differential count of leucocytes was made from blood stained with May-Grunwald-Giesma and each type of cell counted with a counting chamber.

**Statistical analysis:** The data was analyzed using Statistical Analysis System (SAS, 1993). Duncan's (1955) Multiple Range test was used to separate significant treatment means and the following models were used for the growth and haematology studies respectively:

$$Y_{ijk} = \mu + A_{ij} + (X_2 - X_1) + E_{ijk}$$

$Y_{ijk}$ = Effect of the $i^{th}$ dietary treatment on the $j^{th}$ bird in $k^{th}$ period
$\mu$ = General mean effect
$A_{ij}$ = Effect of $i^{th}$ dietary treatment on $j^{th}$ bird
$X_2$ = Final group mean weight after $k^{th}$ period
$X_1$ = Initial group mean weight
$E_{ijk}$ = Random error

$$Y_{ij} = \mu + T_i + E_{ij}$$

$Y_{ij}$ = Observation on the $j^{th}$ bird on the $i^{th}$ treatment
$\mu$ = General mean effect
$T_i$ = Effect due to the $i^{th}$ dietary treatment
$E_{ij}$ = Random error

## RESULTS AND DISCUSSION

Treatment effects on growth, organ and carcass parameters are presented in Table 3.

**Growth parameters:** The final weight and weight gained declined as MOLM level increased. Non significant ($p>0.05$) differences existed between birds on diets 1-3 and 5. This conforms to the general observations made by Ash *et al*. (1992) that inclusion of leaf meals in broiler diets above 5-10% results in depressed performance. Feed intake increased as MOLM inclusion increased probably due to increased bulk and lower metabolisable concentration. Although efficiency of feed utilization decreased with increased levels of MOLM, there were no significant differences between birds on most of the treatments. This observation is supported by the

Table 2: Composition of experimental diets

| | Diets | | | | | | |
|---|---|---|---|---|---|---|---|
| Ingredients | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| CC | 0.00 | 20.00 | 20.00 | 20.00 | 30.00 | 30.00 | 30.00 |
| MOLM | 0.00 | 0.00 | 5.00 | 10.00 | 0.00 | 5.00 | 10.00 |
| Maize meal | 36.00 | 10.00 | 10.00 | 10.00 | 6.00 | 6.00 | 6.00 |
| Maize bran | 20.00 | 18.00 | 18.00 | 15.00 | 8.00 | 5.00 | 5.00 |
| Cotton seed cake | 20.00 | 24.00 | 20.00 | 18.00 | 27.00 | 25.00 | 25.00 |
| Sunflower seed cake | 10.00 | 14.00 | 13.00 | 23.00 | 15.00 | 15.00 | 10.00 |
| Fish meal | 12.00 | 12.00 | 12.00 | 12.00 | 12.00 | 12.00 | 12.00 |
| Premix* | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Salt | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Lime stone | 1.45 | 1.45 | 1.45 | 1.45 | 1.45 | 1.45 | 1.45 |
| **Chemical analysis (%)** | | | | | | | |
| DM | 93.76 | 93.49 | 93.78 | 93.61 | 93.73 | 93.87 | 93.62 |
| ME (MJ/kg) | 12.87 | 13.22 | 12.94 | 12.82 | 12.85 | 12.71 | 13.10 |
| CP | 20.00 | 20.05 | 20.27 | 20.48 | 20.74 | 20.10 | 20.78 |
| CF | 10.74 | 11.22 | 9.84 | 11.74 | 10.84 | 9.33 | 11.59 |
| EE | 6.08 | 6.20 | 6.01 | 6.10 | 6.16 | 5.79 | 5.98 |
| Ash | 13.84 | 13.02 | 12.99 | 12.89 | 12.16 | 13.19 | 13.66 |
| Ca | 1.69 | 1.60 | 1.90 | 1.62 | 1.72 | 1.84 | 1.59 |
| P | 0.43 | 0.42 | 0.41 | 0.44 | 0.44 | 0.46 | 0.42 |

*Vitamin mineral premix contains: vitamin A, 13,340IU; vitamin $D_3$, 2680IU; vitamin E, 10IU; vitamin K, 2.68 mg; calcium D-pantothenate, 10.68 mg; vitamin $B_{12}$ ,0.02 mg; folic acid, 0.668 mg; choline chloride, 400 mg; manganese, 133.34 mg; iron, 66.68 mg, zinc, 53.34 mg, copper 3.2 mg, iodine 1.868 mg, cobalt, 0.268 mg; selenium, 0.108 mg

Table 3: Performance parameters of broilers fed varying levels of CC and MOLM

| | Treatments | | | | | | |
|---|---|---|---|---|---|---|---|
| Parameters | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Initial weight(g) | 129 | 130 | 131 | 131 | 130 | 130 | 132 |
| Final weight (g) | $2501^{a}$ | $2399^{ab}$ | $2342^{ab}$ | $2113^{cd}$ | $2367^{ab}$ | $2215^{bc}$ | $1979^{d}$ |
| Weight gain (g) | $2428^{a}$ | $2354^{a}$ | $2272^{ab}$ | $2001^{c}$ | $2264^{ab}$ | $2099^{bc}$ | $1956^{c}$ |
| Feed intake (g) | $6270^{a}$ | $6285^{a}$ | $6391^{a}$ | $5826^{b}$ | $5814^{b}$ | $6003^{ab}$ | $6347^{a}$ |
| Feed conversion ratio | $2.58^{b}$ | $2.67^{b}$ | $2.81^{b}$ | $2.91^{ab}$ | $2.57^{b}$ | $2.86^{b}$ | $3.26^{a}$ |
| Feedcost/wt gain (TSH) | $1060^{bc}$ | $1005^{c}$ | $1076^{bc}$ | $1166^{b}$ | $979^{c}$ | $1103^{bc}$ | $1360^{a}$ |

$^{abc}$Means on the same row with different superscripts differ significantly (p>0.05). TSH = Tanzanian Shilling

Table 4: Effect of treatment on haematological parameters

| | Treatment | | | | | | |
|---|---|---|---|---|---|---|---|
| Parameters | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| PCV (%) | 30.82 | 29.08 | 29.17 | 30.14 | 29.93 | 27.40 | 28.33 |
| RBC (x $10^6$/µl) | 2.03 | 2.00 | 2.20 | 2.21 | 2.30 | 1.84 | 2.08 |
| HB (%) | 8.01 | 7.62 | 8.15 | 8.10 | 7.64 | 7.06 | 7.80 |
| WBC (x $10^3$/µl) | $12.45^{b}$ | $13.10^{b}$ | $12.40^{b}$ | $13.00^{b}$ | $10.55^{c}$ | $12.55^{b}$ | $14.50^{a}$ |
| Lymphocytes (%) | 57.00 | 58.50 | 56.00 | 56.14 | 57.71 | 58.40 | 57.17 |
| Monocytes (%) | 6.71 | 7.33 | 7.50 | 8.43 | 7.14 | 8.40 | 5.83 |
| Eosinophil (%) | 4.14 | 4.83 | 5.00 | 4.43 | 4.14 | 4.00 | 3.33 |
| Basophil (%) | 0.43 | 0.67 | 0.67 | 1.00 | 0.57 | 0.80 | 0.50 |
| Neutrophil (%) | 31.71 | 28.83 | 30.83 | 30.00 | 30.43 | 28.40 | 32.50 |

findings of Ravindran *et al.* (1983) in which feed intake and feed/gain increased as cassava leaf meal or dehydrated alfalfa meal leaf meals incorporated level was increased. The cheapest feed cost/wt gain were from diets 5 and 2 representing the 30 and 20% cassava groups but did not differ significantly (p>0.05) from diets 1, 3 and 6. The inclusion of cassava in the form of chips even at 30% gave good results hence indicating that the form had no negative effect on the birds and could be a good solution to dustiness and subsequent respiratory problems associated with cassava powder feeding. Yellowing of the colour of the shank, beak and skin of the broilers on *Moringa oleifera* leaf meal were observed and was more pronounced than for birds on 0.0% MOLM. The yellowing observed indicates efficient absorption and utilization of the pigmenting xanthophylls present in MOLM.

The values obtained in the present study for PCV, RBC, Hb fell within the normal ranges as reported by Morton *et al.* (1993, 1994). There were no differences (p>0.05) between treatment means for all parameters, except for WBC. White blood cells are involved in protecting the body from infection and consist of Lymphocytes, Monocytes, Neutrophils, Eosinophils and Basophils. They amongst other functions kill virus-infected cells, enhance the production of antibodies and engulf foreign materials (antigens) that enter the body. A higher presence would therefore connote a threat to normal health and hence the body builds up its defense against such threats. Though *Moringa oleifera* has been claimed to boost immune systems (Jayavardhanan *et al.*, 1994; Fuglier, 1999), it is however most likely that such properties are contained and restricted to the pod which possesses lectin (substance that modulates the body defense system). The general non significance of the WBC across treatments apart from treatment 7 might be indicative that majority of the experimental diets neither impaired nor enhanced the birds ability to wade off infection.

Red Blood Cells (RBC) are responsible for the transportation of oxygen and carbon dioxide in the blood as well as manufacture of haemoglobin hence higher values indicate a greater potential for this function and a better state of health. The non-significant result obtained across treatments implies that the diets did not alter this parameter. Though there was a decline in Hb from the maize based group (T1) and C groups (T2, T5), the differences were not significant ($p>0.05$). This is in contrast to the findings of Tewe (1991) in which 40% whole cassava meals fed to pigs resulted in significantly lower Hb. Cyanide which is contained in cassava has great affinity for metals such as copper and iron and makes them unavailable thereby reducing the haemoglobin count and hence effective oxygen transportation (Tewe, 1991).

The non significant ($p>0.05$) observation made in this study is most likely due to the relatively lower cyanide content and acceptable level for poultry feeding of the CC used (62.33 ug/g) as compared to the whole plant used in Tewe (1991) study. The addition of MOLM in the 20 and 30% CC diets resulted in higher but insignificant ($p>0.05$) Hb values. Though green materials in general and the inclusion of some leaf meals such as chaya leaf meal (Donkoh *et al.*, 1999), *Ipomoea asarifolia* leaf meal (Madubuike and Ekenyem, 2006) *Telfaria occidentalis (*Nworgu *et al.*, 2007) in broiler diets have resulted in significant increases in Hb, the results of this study tend to suggest that MOLM does not possess such "blood tonic effects". There are equally no documented assertions to the possession of this property in Moringa leafs. Treatment had little or no bearing on the amounts of blood cells relative to the total volume of blood (PCV) in the bird's body. The results obtained for PCV followed a somewhat similar pattern with that of Haemoglobin (Hb) indicating that the diets were nutritionally adequate to meet the protein needs of the birds. Low Hb concentrations apart from denoting anaemia also decrease in animals on low protein intake, parasite infection or liver damage (Lindsay, 1977 In: Adeyemo and Longe, 2007).

**Conclusion:** The inclusion of *Moringa oleifera* in cassava based broiler diets up to 5% is possible without negatively affecting productivity or haematological indices. Cassava chips are a very good form of cassava for inclusion in broiler feeds as its utilization was not impaired.

## ACKNOWLEDGEMENTS

The authors are grateful to the African Network of Scientific and Technological Institutions (ANSTI) for providing funds to conduct this research.

## REFERENCES

Adeyemo, G.O. and O.G. Longe, 2007. Effects of graded levels of cottonseed cake on performance, haematological and carcass characteristics of broilers fed from day old to 8 weeks of age. Afr. J. Biotechnol., 6: 1064-1071.

Ash, A.J., L. Petaia and H. Ako, 1992. Nutritional value of *Sesbania grandiflora* leaves for monogastric and ruminants. Tropical Agriculture (Trinidada) 69(3).

Association of Official Analytical Chemists, 1990. Official methods of Analysis. Washington, DC.

Donkoh, A., C.C. Atuahene, Y. Poku-Prempeh and I.G. Twum, 1999. The nutritive value of chaya leaf meal (*Cnidoscolus aconitifolius*): Studies with broiler chickens. Anim. Feed Sci. Technol., 77: 163-172.

Duncan, D.B., 1955. Multiple range and multiple F tests. Biometrics, 11: 1-42.

FAO, 2000. Championing the cause of cassava. FAO Rome.

Fuglier, L.J., 1999. The Miracle Tree: *Moringa oleifera*, Natural Nutrition for the Tropics. Church World Service, Dakkar, Senegal, pp: 68.

Jayavardhanan, K.K., K. Suresh, K.R. Panikkar and D.M. Vasudevan, 1994. Modular potency of drumstick lectin on the host defense system. J. Exp. Clin. Cancer Res., 13: 205-209.

Madubuike, F.N. and B.U. Ekenyem, 2006. Haematology and serum biochemistry characteristics of broiler chicks fed varying dietary levels of *Ipomoea asarifolia* leaf meal. Int. J. Poult. Sci., 5: 09-12.

MDB (Marketing Development Bureau), 1998. Basic Data Agriculture and Livestock Sector (Review). Ministry of Agriculture and Cooperative, pp: 27.

Morton, D.B., D. Abbot and R. Barclay, 1993/1994. Removal of blood from laboratory mammals and birds-First report of the BVA/FRAME/RSPCA/UFAW Joint Working Group on Refinement Laboratory Animals 27. http://www.lal.org.uk/pdffiles/blood. PDF.

Nworgu, F.C., S.A. Ogungbenro and K.S. Solesi, 2007. Performance and some blood chemistry indices of broiler chicken served fluted pumpkin (*Telfaria occidentalis*) leaves extract supplement. American-Eurasian J. Agric. Environ. Sci., 2: 90-98.

PAN, 1995. Annual Reports, Poultry Association of Nigeria, Lagos, Nigeria.

Ravindran, V., E.T. Kornegay and J.A. Cherry, 1983. Feeding values of cassava tuber and leaf meals. Nutr. Rep. Int., 28: 189-196.

SAS Institute Inc., 1993. SAS users Guide; version 6. SAS Institute, Inc., Cary, NC.

Steel, R.G.D. and J.H. Torrie, 1980. Principles and procedures of statistics. McGraw-Hill Book Company: New York, USA.

Tewe, O.O., 1991. Detoxification of cassava products and effects of residual toxins on consuming animals. In: Roots, tubers, plantains and bananas in animal feeding. Proceedings of the FAO Expert Consultation held in CIAT. (Edited by Machin, D. and S. Nyvold), Cali, Colombia, 21-25 January 1991. http://www.fao.org/docrep/003.

Tewe, O.O. and M. Bokanga, 2001. Cost effective cassava-plant based rations for poultry and pigs. Proceedings of the 8th International Society for Tropical Root Crops-Africa Branch symposium, Ibadan, Nigeria, pp: 229-234.