MOIST HEAT TREATMENT AS A METHOD OF IMPROVING THE NUTRITIVE VALUE OF *Icacinia manni* (EARTH BALL) FOR BROILERS

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ABSTRACT

An experiment was conducted to determine the nutritive value of moist heat-treated Icacinia manni (earth ball) meal for broilers. Sun-dried Icacinia manni meal was soaked in water over-night and then put in small plastic sachets and cooked for one hour as is done in the production of moi- moi. Thereafter it was again dried in the sun and milled. The Icacinia manni meal so produced was included in broiler starter diets at 0, 10, 20 and 30%, respectively and each diet fed to a group of 30 young broiler chicks for 4 weeks. At the end of the starter phase, the birds were reshuffled , grouped into 3 of 30 birds each and fed diets containing the meal at 0, 10 and 20%, respectively, for another 4 weeks. The design of the experiment was the completely randomized design (CRD). Daily feed intakes of the groups at the starter phase were 50.80, 31.04, 18.48 and 14.91gm, for the control (0%), 10, 20 and 30%, respectively and were significantly (P<0.05) different. At the finisher phase, the daily feed intakes were 177.58, 93.89 and 86.46gm, respectively and were also significantly (P<0.05) different. Body weight gain, feed conversion ratio and internal organ weights were also depressed by the meal (P<0.05). Haemtological indices were, however, not affected by the treatments (P>0.05)

Key words: *Icacinia manni,* moist heat, nutritive value, broilers.

INTRODUCTION

Poultry is the fastest source of meat which production is less arduous and hazardous compared to other livestock enterprises. An essential part of intensively raised poultry meat production is feeding which constitutes 60-80% of the total production cost (Udedihie, 2003; Esonu *et al*., 2004). However, one of the problems limiting the progress of poultry industry in Nigeria is shortage and high cost of feed ingredients, particularly grains (Oluyemi and Roberts, 2000).

Maize which is the major source of energy in poultry rations constitutes about 60% of the poultry ration. Maize grain is becoming scarce, thus escalating in price because it also serves as a major staple foodstuff for a large population of Nigerians (Udedibie *et al*., 2004). There is the need therefore to search for unconventional energy sources which are relatively cheaper and not directly consumed by man.

One such alternative source of energy for poultry is *Icacinia manni* commonly called *Efik Isong* in Efik and earthball in English. *Icacinia manni* is a shrub with modified tuber which is mainly carbohydrates. It is not directly consumed by man although it is speculated that unscrupulous garri traders adulterate garri with it. The plant is one out of the known species of *Icacinia* plant. It is an all season evergreen shrub plant with well defined root, stem and leaves. Mature tubers can weigh up to 20 kg and their shape and colour vary depending on the soil types and stage of maturity (Asuquo, 2010). It is abundant in the humid tropics of Akwa Ibom State of Nigeria (Akobundu and Agyakwa, 1998).

One serious set-back in the use of *Icacinia manni* tuber as energy ingredient for non-ruminants is its content of some antinutritional factors such as hydrogen cyanide, phytic acid and oxalic acid (Fassiet, 1973; Isika *et al*, 2005). However Umoren *et al* (2003) reported that the hydrogen cynanide, oxalic acid and phytic acid in it reduced drastically after fermentation.

Not much work has been done on the potential of *Icacinia manni* tuber as feedstuff for poultry. Umoren *et al* (2003) reported a satisfactory growth response by broilers at 15% dietary inclusion of Icacinia *manni* fermented with cassava. But Asuquo (2010) reported severe drop in feed intake, body weight loss and egg production of laying hens with 10% dietary level of toasted *Icacinia manni* tuber meal.

This paper reports the performance of broilers fed diets containing moist heat-treated *Icacinia manni* tuber meal.

Figure 1: *Icacinia manni* tuber

MATERIALS AND METHODS

Experimental Site:

The study was conducted in the poultry unit of the Teaching and Research farm of the University of Uyo, Uyo-Akwa Ibom State of Nigeria, and Department of Animal Science laboratory of the University. The haematological aspects of the study were done at the University Medical Center.

Uyo, the Akwa-Ibom State Capital, lies between latitude $4^0\,4^1$ and $5^0\,0^1$ and longitude $7^0\,45^1$ and $8^0\,05^1$. It has an average annual rainfall of 1400mm and temperature range of 23 – 30^0c (Multinational Diaries, 2008).

Source and Processing of the *Icacinia manni* Tubers

Fresh *Icacinia manni* tubers were harvested from the fallow land within the suburb of Uyo. The tubers (figure 1) were washed and then chopped into small pieces, sun-dried and then milled. Thereafter, it was soaked in water overnight and then put in small plastic sachets and cooked for one hour as is done in the production of *moi-moi.* This was to avoid the instance of its extensive gum formation (by the meal) that occurs if it is cooked in direct contact with water. Fresh *Icacinia manni* tubers were observed to contain a lot of gummy substance(s) believed to be galactomannan gum (Scatt *et al*, 1047).

The cooked *Icacnia manni* tuber meal (1MM) was again sun-dried and milled. Samples of the meal was analyzied for phytochemical and proximate composition according to AOAC (1990). The phytochemical component analyzed for were hydrogen cynanide, tannins, glycosides, phytates, alkaloids and saponins.

Experimental Diets

Four experimental diets were formulated for the starter phase of the trial. Diet 1 (control) contained maize as the main source of energy while diets 2, 3 and 4 contained 10, 20 and 30% 1MM, replacing maize on weight by weight basis. For the finisher phase, 3 diets were made such that diet 1 (control) contained maize as the main source of energy while diets 2 and 3 contained 1MM at 10 and 20% levels, respectively. Ingredient and calculated chemical composition of the diets are shown in Tables 1 and 2.

Experimental Birds and Design

A total of 120 day-old Anak broiler chicks were used. In the starter phase, the chicks were divided into 4 groups of 30 birds each and randomly assigned to the 4 experimental starter diets, using completely randomized design. Each group was further sub-divided into 3 replicates of 10 birds each and each replicate housed in 2 m x 2 m pen. Before the start of the experiment, the birds were given a commercial starter feed for one week. The experimental starter diets were given thereafter for 4 weeks.

At the end of the starter phase, the birds were reshuffled such that all the treatment groups had similar initial body weight for the start of the finisher phase. The finisher diets were then fed for another 4 weeks. Thirty percent (30%) level diet was withdrawn at the finisher phase as a result of the very poor performance of the starter birds at that level. Weights of the birds were taken at the beginning of each phase and weekly thereafter to determine the body weight changes. Feed and water were given *ad libitum*. The study lasted for a period of 9 weeks.

Data Collection and Analysis

Data collected included initial body weights, feed intake and feed conversion ratio. Feed intake was determined by subtracting the weight of the left-over feed from the weight of the feed offered the previous day. Daily body weight gain was determined by dividing total body weight gain by the number of days that the experiment lasted. Feed conversion ratio was determined by dividing daily feed intake by the daily body weight gain of the birds in each treatment.

At the end of the finisher phase, 4 birds of similar weights were randomly selected from each treatment, slaughtered, eviscerated and used for determination of the internal organ weights as well as the haemotological and serum biochemical indices. The birds were weighed before slaughter to determine their live-weights. Thereafter, they were defeathered and eviscerated and their internal organs (liver, heart, and gizzard) as well as the abdominal fat weighed and expressed as percent of the live-weight.

Blood was collected from the birds as they were slaughtered into specimen bottles with and without ethylene diamine tetracetic acid (EDTA) as the anti-coagulant for haematological and serum biochemical indices. Haematological and serum biochemical indices were determined according to Monica (1984).

Data Analysis

Data generated were subjected to analysis of variance (ANOVA) as outlined by Steel and Torrie (1980) based on completely randomized design (CRD). Where ANOVA detected significant treatment effects, means were compared using the New Duncan's Multiple Range Test (NDMRT) as outlined by Obi (1990).

RESULTS AND DISCUSSION

Proximate and Phytochemical Composition of the Test Material

The proximate and phytochemical composition of the moist heat-treated *Icacinia manni* tuber meal is shown in Table 3.

The 1MM seemed to be low in crude protein (5.76%) but relatively high in nitrogen-free extract (75.30%), showing that it is an energy feedstuff. The proximate values did not differ from the values earlier reported by Asuquo (2010) who worked with toasted form of the tuber.

The phytochemical analysis indicated high contents of saponins (10 mg/100g). This could be responsible for somehow bitter taste associated with the tuber. Saponins are known to cause injury to digestive mucosa and haemolytic changes in blood. The alkaloid value was relatively high too (4.83 mg/100g). Alkaloid are lethal to chickens and toxic to other monogestric animals and young ruminants (Scott *et al*, 1947). No traces of HCN were observed from the meal as was reported by Asuquo (2010). The meal was quite low in tannins and glycosides but quite high in phytate as reported by Fassiet (1973) and Umoen *et al* (2003).

Performance of Starter Broilers

Data on the performance of the starter broilers are presented in Table 4. Feed intake, body weight gain and feed conversion ratio of the birds were severely depressed by dietary moist heat-treated *Icacinia manni* tuber meal (P<0.05). At 30% dietary inclusion of the meal, feed intake and body weight gain of the birds dropped by about 70 percent.

The results agree with the report of Ikpechukwu (2007) and Usoro (2007) in similar works with young growing rabbits and those of Asuquo (2010) and Owokere (2010) in their works with layers and broilers, respectively.

Mortalities of 10% and 13% were recorded at 20% and 30% dietary levels, respectively. These were above the limit of 5% suggested by Oluyemi and Roberts (2000) under good management practice in the tropics.

Performance of the Finisher Broilers

Data on the performance of the finisher broilers are presented in Table 5. Feed intake, body weight gain and feed conversion ratio were also significantly

(P<0.05) depressed by dietary moist heat-treated *Icacinia manni* tuber meal even at 10% level. The results were also in agreement with the reports of Ikpechukwu (2007) and Usoro (2007) in similar works with young growing rabbits and those of Asuquo (2010) and Owokere (2010) on layers and broilers, respectively.

Data on dressed weights and the weights of the internal organs of the birds are presented in table 6. The dressed weights of the broilers significantly declined as the dietary levels of *Icacinia manni* tuber meal increased but the differences were not significant (P>0.05). The weights of livers, spleens and gizzards were also not affected by the treatments (P>0.05) but the abdominal fat was severely reduced at both levels of inclusion (P<0.05). The weight of the hearts were affected at 10% dietary level (P<0.05).

Data on the haematological and serum biochemical indices are presented in Table 7. White blood cells (WBC), red blood cells (RBC), haemoglobin counts (Hb), mean cell haemoglobin concentrations (MCHC), packed cell volume (PCV) and lymphocytes were not affected by the treatments (P>0.05). Neutrophils, monocytes and eosinophils were significantly (P<0.05) depressed at 20% dietary level of the meal. Whereas the values for WBC and Hb were within the range reported by Orji *et al* (1987) and Mitruka and Rawnsley (1977) as normal for birds, RBC values were lower than the range suggested by them as normal.

The serum biochemical indices did not follow any pattern. Blood urea, creatinine, serum glutamate phosphate transferase (SGPT) and serum glutamate oxaloacetate transferase (SGOT) were not affected by the treatments (P>0.05). Blood total protein was depressed at 10% dietary level (P<0.05) while albumin was depressed at both 10 and 20% dietary levels. The results tended to show that the problem of the tuber meal is not necessary in its metabolism but at the level of feed intake. Functions of the blood are generally influenced by quantity and level of antinutrients present in feeds (Ahamefule *et al*; 2006).

CONCLUSION

The results of the trial have shown that moist heat treatment is not effective as a means of detoxifying *Icacinia manni* tuber so as to render it utilizable as a source of dietary energy for broilers since it could not be tolerated even at 10% dietary level. The significance of its high content of gummy substances should be investigated since gums such as galactomannan gum is believed to be harmful to monogastrics.

Table 1: Ingredients composition of the experimental broiler starter diets

Ingredients (%)	**Control**	**10% IMM**	**20% I,MM**	**30% IMM**
Maize	50.00	40.00	30.00	20.00
Cooked *Icacinia manni*	-	10.00	20.00	30.00
Soya bean meal	25.00	25.00	25.00	25.00
Fish meal	3.00	3.00	3.00	3.00
Blood meal	3.00	3.00	3.00	3.00
Palm kernel cake	5.00	5.00	5.00	5.00
Wheat offals	10.00	10.00	9.50	9.50
Bone meal	3.00	3.00	3.00	3.00
TM/vit. Premix*	0.25	0.25	0.25	0.25
L-Methionine	0.25	0.25	0.25	0.25
L-Lysine	0.25	0.25	0.25	0.25
Common salt	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Calculated chemical composition (% DM)				
Crude Protein	22.85	22.73	22.36	22.17
Ether extract	3.68	3.68	3.68	3.68
Crude fibre	3.68	3.68	3.68	3.68
Ash	3.14	3.14	3.14	3.14
NFE	66.32	65.53	66.50	66.70
Calcium	0.37	0.37	0.37	0.37
Phosphorus	0.17	0.16	0.16	0.16
ME (kcal/kg)	2851.70	2851.70	2851.70	2851.70

* To provide the following per kg of feed: Vitamin A, 10000iu; Vitamin D_3 1500iu, Vit B_1, 8mg; Choline, 350mg; Folic acid, 4mg; Mg, 56mg; Iodine, 1.0mg; Iron, 20mg; Cu, 10mg; Zn., 0.5mg.

Table 2: Ingredient composition of the experimental broiler finisher diets

Ingredients (%)	Control	10% IMM	20% IMM
Maize	60.00	50.00	40.00
Cooked *I. manni*	-	10.00	20.00
Soya bean meal	19.00	19.00	19.00
Fish meal	2.00	3.00	3.00
Blood meal	2.00	2.00	2.00
Palm kernel cake	5.00	5.00	5.00
Wheat offals	8.00	7.00	7.00
Bone meal	3.00	3.00	3.00
TM/vit. Premix*	0.25	0.25	0.25
L-Methionine	0.25	0.25	0.25
L-Lysine	0.25	0.25	0.25
Common salt	0.25	0.25	0.25
Total	100.00	100.00	100.00
Calculated chemical composition (% DM)			
Crude Protein	19.52	19.38	19.28
Ether extract	3.73	3.77	3.77
Crude fibre	3.92	3.68	3.68
Ash	2.74	2.84	2.89
NFE	69.59	69.73	69.84
Calcium	0.28	0.35	0.38
Phosphorus	0.14	0.14	0.14
ME (kcal/kg)	2830.10	2830.10	2830.10

* To provide the following per kg of feed: Vitamin A, 10000iu; Vitamin D_3, 1500iu; Vit. B_1, 8mg; Choline, 350mg; Folic acid, 4mg; Mg, 56mg; Iodine, 1.0mg; Iron, 20mg; Cu, 10mg; Zn., 0.5mg

Table 3: Proximate and phytochemical composition of moist heat- treated *lcacina manni* meal

Components	contents
Dry matter, %	95.40
Crude protein, %DM	5.76
Crude fibre, %DM	11.76
Ether extract, %DM	4.21
Ash, %DM	2.97
NFE, %DM	75.3
HCN, ppm	0.00
Tannins (mg/100gm)	0.36
Glycosides (mg/100gm)	0.42
Phytate (mg/100gm)	8.25
Alkaloids (mg/100gm)	4.93
Saponins (mg/100g)	10.00

Table 4: Performance of the experimental starter broilers

Parameters	**Experimental diets**				
	0% IMM	**10% IMM**	**20% 1MM**	**30% IMM**	**SEM**
Av. initial body Wt. (g)	107.60	104.33	109.67	106. 67	3.32
Av. final body Wt. (g)	613.57[a]	342.93[b]	235.77[b]	158.43[c]	12.89
Av. body wt. gain (g)	505.90[a]	107.6[b]	126.10[c]	52.86[d]	5.41
Av. daily body Wt gain (g/d)	18.07[a]	8.52[b]	4.50[c]	1.89[d]	0.44
Av. daily feed intake (g)	50.80[a]	31.04[b]	18.46[c]	14.19[c]	2.69
Feed conv. ratio (g feed/g gain)	2.81[a]	3.64[b]	4.10[b]	7.89[c]	1.90
Mortality (number)	0.00	0.00	3.00	4.00	-

[abcd]Means within a row with different superscripts are significantly different (p<0.05).

Table 5: Performance of experimental finisher broilers

Parameters	0% IMM	10% IMM	20% IMM	SEM
Av. initial body wt. (g)	407.72	402.91	416.42	6.35
Av. final body wt. (g)	1762.34[a]	1125.22[b]	991.33[c]	47.50
Av. body wt. gain (g/d)	1354.20[a]	722.14[b]	574.93[c]	38.75
Av. daily body wt. gain (g/d)	48.36[a]	25.79[b]	20.53[c]	1.69
Av. daily feed intake (g)	117.58[a]	93.89[b]	86.49[c]	1.07
Feed conv. ratio (g feed/g gain)	2.43[a]	3.67[b]	4.23[c]	0.17
Mortality (number)	0.00	0.00	0.00	0.00

[abc] Means within a row with different superscripts are significantly different (p<0.05).

Table 6: Effects of IMM on internal organ weights of the experimental broilers

Organ	Dietary Levels of IMM			
	0% IMM	10% IMM	20% IMM	SEM
Dressed weight (%)	60.98	51.86	51.86	4.21
Liver, % LW	2.40	2.89	2.60	0.24
Heart, % LW	0.54[a]	0.58[a]	0.45b	0.02
Spleen,% LW	0.14	0.15	0.15	0.01
Gizzard, % LW	2.45	2.71	2.73	0.20
Abdominal fat ,% LW	1.42[a]	0.66[b]	0.58[b]	0.18

[ab] Means within a row with different superscripts are significantly different (P< 0.05)
LW = live–weight

Table 7: Effects of experimental diets on hematological and Serum Biochemical indices of the finisher broilers

	Dietary levels of IMM			
Indices	**0% IMM**	**10% IMM**	**20% IMM**	**SEM**
WBC ($x10^5$/g)	133.50	170.61	151.77	3.48
RBC ($x10^2$/g)	2.67	2.60	2.50	0.15
HB (g / dl)	13.63	12.13	11.57	0.72
MCHC	34.37	33.77	33.73	0.67
PCV (%)	4.53	4.04	3.86	0.24
Neutrophils (%)	2.67^a	2.67^a	0.33^b	0.75
Lymphocytes (%)	81.33	78.33	73.67	4.80
Monocytes (%)	1.33^a	2.03^a	0.33^b	o.43
Eosinophils (%)	11.67^a	13.06^a	24.33^b	4.61
Basophils (%)	3.33^a	4.04^a	1.33^b	1.88
Urea (mg /100ml)	0.58	0.64	0.82	0.20
Creatinine (mg /100ml)	171.33	123.57	193.87	4.59
Total Protein (mg /100ml)	35.07^a	23.03^b	25.43^a	2.15
SGPT ALT (u /L)	7.67	9.04	4.33	1,28
Alkaline phosphate (u /L)	276.07	276.07	273.60	0.66
Albumin (mg/100ml)	14.03^a	8.37^b	9.77^b	0.07
SGOT AST (u /L)	114.67	66.67	74.67	9.54

^{ab} Means within a row with different superscripts are significantly different ($p<0.05$).

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