EFFECTS OF DIETARY TOASTED *Icacinia manni* MEAL ON THE PERFORMANCE OF LAYING HENS

L.E. Asuquo and A.B.I. Udedibie*

Department of Animal Science
University of Uyo, Uyo Akwa-Ibom State-Nigeria
*Permanent Address: Federal University of Technology, P.M.B. 1526, Owerri-Nigeria

Abstract

An experiment was conducted to determine the effects of dietary toasted *Icacinia manni* (earth ball) meal (TIMM) on egg production, egg quality characteristics and blood indices of laying hens. Three diets were made such that diet 1 (control) contained no TIMM while diet 2 and 3 contained 10% and 20% TIMM, respectively. Each diet was fed to a group of 24 laying hens at six months of laying life for 12 weeks in a completely randomized design. Data generated were subjected to one-way analysis of variance. The daily feed intakes were 130.87 gm, 68.57 gm and 34.50 gm, respectively and significantly ($P<0.05$) different. At 20% dietary level, TIMM significantly ($P<0.05$) depressed hen-day egg production. Egg weights and feed conversion ratios were also significantly ($P<0.05$) affected by the treatments although the hens on 10% TIMM produced relatively heavier eggs. Blood indices and weights of the internal organs were not affected by the treatments ($P<0.05$). It is concluded that TIMM could not be tolerated by laying hens even at 10% dietary level.

Keywords: *Icacinia manni*, toasting, feed ingredient, laying hens

Introduction

An important part of raising chickens is feeding which incidentally makes up the major part of the production process. In Nigeria, the most important factor limiting against expansion of poultry industry is the shortage and high cost of feed ingredients, particularly grains (Oluyemi and Roberts, 2000). Cost of feeding has been put at 60 - 80% of the cost of production for intensively reared livestock, especially poultry and pigs (Udedibie, 2003).

Udedibie *et al* (2004) stated that the use of maize in ration formulation becomes expensive because of scarcity following increasing pressure on it as staple food for human, feed for livestock and industrial raw material. Thus there is an increase in feed cost with concomitant increase in the cost of poultry products. Consequently, there is need to search for some alternative energy feeds which are not directly consumed by man.

One possible source of energy in poultry diets in Nigeria is *Icacinia manni* commonly called Earth ball. *Icacinia manni* is a shrub with modified tuber which is mainly carbohydrate. It is one out of the 13 known species of *Icacinia* plant. It is an all season evergreen shrub with well defined root, stem and leaves. The tubers (Figure.1) weigh up to 20 kg, vary in shape and color, depending on the soil type and stage of maturity. The plant is a common wild field crop, forest re-growth, fallow or wasteland and is abundant, particularly in the humid tropics of Akwa Ibom State of Nigeria (Akobundu and Agyakwa, 1998). The tuber contains some anti-nutritional factors such as hydrogen cyanide, alkaloids, phytic acid and tannins which limit its use as animal feed (Fassiet, 1973; Antai and Obong, 1992).

Information on the value of *Icacinia manni* tuber meal as animal feed is quite limited. Recent research on it by Umoren *et al* (2003) showed that it could be tolerated to some extent by broilers if fermented with cassava.

This paper reports the effects of toasting as a method of processing *Icacinia manni* tuber meal as dietary source of energy for laying hens.

Materials and Methods

The study was carried out in the Teaching and Research farm of the University of Uyo, Uyo, Akwa-Ibom State, Nigeria. The proximate analysis of the test material was done in the Department of Animal Science laboratory while haematological

indices were determined at the Medical Centre of the University.

Uyo is the Capital of Akwa-Ibom State of Nigeria. It lies between latitude $40^{0}4^{1}$ and $5^{1}0^{1}$ and longitude $7^{0}45^{1}$ and $8^{0}05^{1}$ with an average annual rainfall of 1400 mm and temperature range of 23 to 30^{0}c (Multinational Diaries, 2008).

Source and Processing of *Icacinia Manni* Tubers

The fresh *Icacinia manni* tubers were harvested from fallow lands in the wild at Ikot Mbonde in Itu Local Government Area of Akwa-Ibom State. They were washed thoroughly and then chopped into small slices and sun-dried for 4 - 5 days. The sun-dried chips were then milled and toasted to produce toasted *Icacinia manni* tuber meal.

Toasting was done as is done in garri production by turning small quantity of the meal on a pan seated on fire until it changed colour and became crispy to the touch. Samples of fresh *Icacinia manni* meal (FIMM),sun-dried *Icacinia manni* meal (SIMM) and toasted *Icacinia manni* meal (TIMM) were analyzed for proximate composition according to AOAC (1990) and for hydrogen cyanide (HCN) according to Bradbury *et al* (1999).

Figure 1: Icacinia manni tubers

Experimental Diets

Three experimental laying diets were made such that diet 1 (control) contained maize as the main source of energy while diets 2 and 3 contained 10% and 20% TIMM, respectively, partly replacing the maize in the control diet. Other ingredients in the diets remained the same (Table 1).

Experimental Birds and Design

A total of 72 laying hens at 6 months of laying life were used for the experiment. They were divided into 3 groups of 24 birds each and each group randomly assigned to one of the diets in completely randomized design (CRD). Each group was further sub-divided into 3 replicates of 8 birds each and each replicate housed in a pen measuring 1½ m x 1½ m. Wood shavings were used as litter material. The birds were weighed at the beginning and the end of the trial to determine their body weight changes. Feed and water were provided *ad libitum*. The trial lasted 12 weeks.

Data Collection and Analysis

Data collected included initial and final body weights, feed intake, feed conversion ratio, egg production, egg weights, egg quality indices, internal organ weights and haematological indices of the hens. Feed intake was determined by subtracting the weight of the left-over feed from the weight of the feed offered the previous day. Eggs were collected twice daily. At the end of each week, the eggs collected from each pen were weighed to determine the average egg weight and feed conversion ratio (kg feed/kg eggs). Egg shell thickness was determined with micrometer screw gauge after the membrane from each shell was removed. Measurement was taken from three

points on the shell. Egg yolk index was determined according to Sharp and Powell (1930) as modified by Funk (1948). Albumen index was determined according to Wilhelm and Heiman (1936). Egg Haugh unit was determined according to Haugh (1937) as modified by Brant *et al* (1951).

At the end of the feeding trial, 4 birds were randomly selected from each treatment and used for determination of haematological indices and weights of the internal organs. Hamatological indices determined were haemoglobin count (HB), red blood cell (RBC), white blood cells (WBC), packed cell volume (PCV), neutrophils, lymphocytes and eosinophils. These were determined according to Monica (1984).

Data generated were subjected to analysis of variance (ANOVA) as outlined by Snedecor and Cochran (1978). Where analysis of variance detected significant treatment effects, means were compared using New Duncan Multiple Range Test (NDMRT) as outlined by Obi (1990).

Results and Discussion

Cyanide/Proximate Composition

The HCN content and proximate composition of *Icacinia manni* tuber meal used for the trial are presented in table 2. The fresh *Icacinia manni* tuber meal (FIMM) used in the study had no trace of HCN on the picrate paper of cyanide kit B_2 of Bradbury *et al* (1999). This observation tended to contradict the findings of Umoren *et al* (2003) that it contains HCN. Existence of HCN in feedstuffs is believed to depend on the depth of the tuber in the soil and soil type (Akinrele, 1967). Cassava tuber develops within the depth of 0 – 25 mm of the soil while *Icacinia manni* grows far beyond that depth. This could explain the non-existence of HCN observed in this study.

The proximate composition of 6.13% crude protein, 5.00% ether extract, 8.62% crude fibre, 3.80% ash and 76.45% nitrogen-free extract obtained for sun-dried *Icacinia manni* tuber meal shows that it is higher than cassava in crude protein but similar to it as source of energy. Toasting did not appear to seriously affect the proximate composition.

Performance of the Experimental Laying Hens

The effects of toasted *Icacinani manni* tuber meal (TIMM) on the performance of the laying hens are presented in Table 3. There were significant differences among the treatment groups in feed intake ($P< 0.05$). TIMM seemed to contain feed intake depressing factor(s).

Similar study by Ikpechukwu (2007) with rabbits produced similar results. Body weight changes followed the feed intake trend. Whereas the birds on the control diet gained about 80 gm of body weight, those on 10% and 20% TIMM diets lost about 80 gm and 320 gm of body weight, respectively. The results tended to agree with the reports of Fassiet (1973) that *Icacinia manni* tubers contain some anti-nutritional factors that limit its use as animal feed although the one that so badly affects feed intake is yet to be identified.

There were also significant differences in hen-day egg production with *Icacinia manni* groups producing much less number of eggs than the control ($P< 0.05$). The results show that *Icacinia manni* is quite different from other tubers as source of energy in poultry diets, particularly layers. Recent studies at our station have demonstrated that sun-dried cassava tuber meal could effectively replace 50% of dietary maize in laying diets (Enyenihi *et al*, 2009) and when processed into *fufu* meal, cassava tuber meal could completely replace dietary maize in laying diets (Udedibie *et al*., 2008). And cocoyam corm, another tuber, could replace 75% of maize in the diet of young growing pigs (Ohamaenyi, 1993). Both egg weight and feed conversion ratio were adversely affected by the meal ($P< 0.05$).

Egg Quality Characteristics

Data on the egg quality characteristics are presented in table 4. There were no significant differences among the treatments in egg shell thickness ($P> 0.05$). Feeding trials with other tubers like cassava also tended to show that egg shell thickness is not affected by the dietary tuber meals (Udedibie *et al*., 2008; Enyenihi *et al*., 2009; Enyenihi, 2012). However, Haugh unit, albumen and yolk indices were badly depressed by *Icacinia manni* meal ($P< 0.05$).

Internal Organ Weight

Data on the internal organ weights of the layers are presented in Table 5. There were no significant differences ($P> 0.05$) among the groups in liver, spleen and gizzard weights. There were however significant ($P<0.05$) differences among the treatments in the weights of the hearts. The existence of no significant differences in liver weights was an indication that the toasted *Icacinia manni* meal did not inflict the liver with serious toxicity. Atuahene *et al* (1986) and Bamgbose and

Niba (1995) associated significant heavier weights of birds fed diets containing high levels of raw cotton seed meal with presence of toxic factors in the diets.

Haematological Indices

Data on the haematological indices of the laying hens are presented in Table 6. Haematological indices (haemaglobin estimate, red blood cells, white blood cells, PCV, neutrophils and lymphocytes) were not affected by the treatments ($P>0.05$), and the values obtained were within the range reported by Mitruka and Rawnsley (1977) and Orji *et al* (1987) as normal for poultry birds. Only the eosinophils were significantly ($P<0.05$) reduced by *Icacinia manni* diets. The reason for this could not be ascertained immediately.

Conclusion

The results of the study have shown that dietary toasted *Icacinia manni* meal reduces feed intake of laying hens even at 10% dietary inclusion level. It depressed egg production and caused severe body weight loss at 20% dietary level. It appears therefore that for egg production, toasted *Icacinia manni* meal should not be included in the diet of laying hens up to 10% level. There is the need for investigation into other ways of processing the tuber so as to achieve a relatively higher level of dietary inclusion.

References

Akinrele, I.A. (1961). Fermentation of cassava. *J. Sci. Ed. Agric.*, 15:589 -594.

Akobundu, I.O. and Agyakwa, C.W. (1998). *A hand book of West African Weeds.* 2nd revised ed., IITA, Ibadan: INTEC Printers, Nigeria.

Antai, S.P. and Obong, U.S. (1992). The effects of fermentation on the nutrient status of some toxic components of *Icacinia manni*. *Plant Fd. For Hum. Nutrition*,. 42:219 - 224.

AOAC. (1990). Association of Official Analytical Chemists. *Official Methods of Analysis.* 14th ed., Washington DC.

Atuahene, C.C., Don Koh, A. and Nkansah Diko, P. (1986). Effects of raw cotton seed meal on the performance, carcass characteristics and certain blood parameters of broiler chickens. *J. Anim. Prod. Res.*, 6:107 - 114.

Bamgbose, A.M. and Niba, A.T. (1995). Carcass traits, relative organ weights and gut characteristics of broiler chickens fed cotton seed cake in starter and finisher rations. *Anim. Prod. Res*., 11:68 - 73.

Bradbury, M.E., Egan, S.V. and Bradbury, J.H. (1999). Pirate paper kits for determination of total cyanogens in cassava root and all forms of cyanogens in cassava products. *J. Sci. Fd. Agric.*, 79:595 - 601.

Brant, A.W., Otoo, J.A. and Norrisk, K.H. (1951). Recommended standards for scoring and measuring opened egg quality. *Food Tech.,* 5:356 - 361

Enyenihi, G.E. (2012). Gelatinization of fermented cassava tuber meal and its nutritive value for laying hens. PhD Thesis, Fed. Univ. of Tech., Owerri-Nigeria.

Enyenihi, G.E., Udedibie, A.B.I, Akpan, M.J., Obasi, O.L. and Solomon, I.P. (2009). Effects of 5-hr wetting of sun-dried cassava tuber meal on the HCN content and dietary value of the meal for laying hens. *Asian J. Anim. Vet. Adv.*, 4 (6): 326 - 331.

Fassiet, D.W. (1973). Oxalates. In: Toxicants occurring naturally in foods., Washington D.C., Acad of Science.

Funk, E.M. (1948). The relation of the yolk index determination in the natural position to the yolk index determined by separating the yolk from the albumen. *Poultry Science*, 27:367.

Haugh, R.R (1937). The Haugh unit for measuring egg quality. *US Poultry, Mag.*, 2:552 - 555.

Heiman, V. and Carver, J.S. (1936). The albumen index as a physical measurement of egg quality. *Poultry Science*, 15:141 - 148.

Ikpechukwu, E. (2007). Effects of toasted *Icacinia manni* meal-based diet on the performance of weaner rabbits. B. Agric. Project, Dept. of Animal Science, University of Uyo, Uyo-Nigeria.

Mitruka, B.M. and Rawnsley, H.M. (1977). *Chemical Biochem. And Haematological Ref. In Normal Experimental Animals.* Masson Publ., N.Y., PP. 54 - 55.

Monica, C. (1984). *Medical Lab. Manual for Tropical Countries*. Vol. 11, Microbiology, ELBS ed.

Multinational Diaries (2008). Akwa Ibom Government diary, P. 5.

Obi, J.U. (1990). *Statistical Methods of Detecting Differences between Treatment Means*, 2nd ed., Snapp Press, Enugu-Nigeria.

Ohamaenyi, C.E. (1993). A study of corms of *Xanthosoma dignittifolium* in the diet of young growing pigs. B. Agric. Project Report, Fed. Univ. of Tech., Owerri, Nigeria.

Oluyemi, I.A. and Roberts, F.A. (2000). *Poultry Production in the Warm Wet Climate*. Spectrum BK Ltd., Ibadan-Nigeria, PP. 147 - 165.

Orji, B.I., Okeke, G.C. and Akunyiba, A.O. (1987). Haematological studies on the guinea fowl (*Numida meleagris*). Effect of age, sex and season. *Nig. J. Anin. Prod.,* 13 (1): 99 - 100.

Sharp, P.F. and Powell, C.K. (1930). Decrease in interior quality of hen's egg during storage as influenced by the yolk. *Ind. Eng. Chem.,* 22:908.

Snedecor, G.W. and Cochran, W.G. (1978). *Statistical Methods*, 6th ed., Iowa State Univ. Press, Iowa.

Udedibie, A.B.I. (2003). In Search of Food: FUTO and the Nutritional Challenge of *Canavalia* Seeds. 6th Inaugural Lecture, Fed. Univ. of Tech., Owerri-Nigeria.

Udedibie, A.B.I., Anyaegbu, B.C., Onyechekwa, G.C. and Okpuokporo, O.C. (2004). Effects of feeding different levels of fermented and unfermented cassava tuber meals on performance of broilers. *Nig. J. Anim. Prod.,* 31:211 - 219.

Udedibie, A.B.I., Enyenihi, G.E., Akpan, M.J., Solomon, I.P. and Obasi, O.L. (2008). Physiochemical nature and nutritive value of dried cassava *fufu* meal for laying hens. *Niger. Agric. J.* 39:44 - 49.

Umoren, U.E., Essien, A.I. and Ntukepo, L.L. (2003). The chemical evaluation of cassava and *Icacinia manni* mixture under various stages of fermentation. *J. Applied Sci.,* B (3): 3669 - 3676.

Wilhelm, I.A. and Heiman, V. (1936). Albumen index determination by normogram. *US Egg and Poultry Mag.,* 42: 426 - 429.

Table 1: Ingredient composition of the experimental diets

Ingredients %	Diet 1 Control	Diet 2 10%TIMM	Diet 3 20%TIMM*
Maize	50.00	40.00	30.00
TIMM*	0.00	10.00	20.00
Soyabean meal	16.00	16.00	16.00
Fish meal	2.00	2.00	2.00
Blood meal	2.00	2.00	2.00
Palm Kernel cake	7.00	7.00	7.00
Wheat offal	12.00	12.00	12.00
Bone meal	5.00	5.00	5.00
Oyster shell	5.00	5.00	5.00
Common salt	0.25	0.25	0.25
Vit/Tm premix**	0.25	0.25	0.25
L-Lysine	0.25	0.25	0.25
L-methionine	0.25	0.25	0.25
Calculated chemical composition (%DM)			
Crude protein	17.50	17.16	16.91
Calcium	3.94	3.93	3.92
Phosphorus	1.32	1.34	1.34
ME (Mcal/kg)	2.56	2.52	2.50

*TIMM = Toasted *Icacinia manni* meal

** To provide the following per kg of feed: Vit. A, 10,000 iu; Vit.D_3, 150 iu; Vit. E, 3 iu; Vit. K, 2 mg; Riboflavin, 3 mg; Panthothenic acid, 6mg Niacin, 15 mg; Vit. B_{12}, 8 mg; Choline, 350 mg; Folic acid, 4 mg; Mg, 56 mg; Iodine, 1 mg; Iron, 20 mg; Cu, 19 mg; Zn, 0.5 mg.

Table 2: HCN content (ppm) and proximate composition of *Icacinia manni* tuber (% of dm)

Components	FIMM	SIMM	TIMM
HCN (ppm)	0.00	0.00	0.00
Crude protein	ND	6.13	6.15
Ether extract	ND	5.00	4.88
Crude fibre	ND	8.62	8.81
Ash	ND	3.80	3.81
Nitrogen-free extract		76.45	76.35

FIMM = Fresh *Icacinia manni* meal
SIMM = Sun-dried *Icacinia manni* meal
TIMM = Toasted *Icacinia manni* meal
ND = Not determined

Table 3: Performance of laying hens fed diets containing toasted *Icacinia manni* meal

Parameter	Dietary levels of TIMM			
	(0%)	10%	20%	
Av. initial body weight (kg)	1.7.1	1.72	1.73	0.066
Av. final body weight (kg)	1.79^{a}	1.64^{a}	1.41^{b}	0.06
Av. body weight changes (kg)	0.08	-0.08	-0.32	0.01
Av. feed intake (g/day)	130.87^{a}	68.57^{b}	34.5^{c}	0.71
Av. hen-day egg prod. (%)	50.00^{a}	22.62^{a}	18.45^{b}	3.92
Av. egg weight (g)	60.00^{a}	62.00^{a}	21.16^{b}	12.60
Feed conversion ratio (kg feed/kg eggs)	2.18^{a}	1.90^{a}	1.63^{b}	0.12

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

Table 4: Effects of toasted *Icacinia manni* meal on egg quality indices of the laying hens

	Dietary levels of TIMM			
Parameters	0.% (control)	10%	20%	SEM
Haugh unit	89.02[a]	74.32[b]	71.14[b]	3.48
Shell thickness (mm)	0.38	0.37	0.32	0.013
Albumen height (cm)	0.85[a]	0.80[a]	0.20[b]	0.07
Albumen width (cm)	8.00[a]	7.86[a]	1.93[b]	0.09
Albumen index	0.105[a]	0.06[b]	0.033[b]	0.014
Yolk height (cm)	1.67[a]	1.75[a]	0.46[b]	0.16
Yolk width (cm)	4.57[a]	3.99[a]	1.05[b]	0.63
Diameter (cm)				
Yolk index	0.37	0.44[a]	0.14[b]	0.05

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

Table 5: Effects of toasted *Icacinia manni* on internal organ weights of laying birds

	Dietary levels of TIMM			
Organs (% of body wt)	0%	10%	20%	SEM
Liver	4.30	4.42	4.32	0.35
Heart	0.70[a]	0.56[b]	0.56[b]	0.03
Spleen	0.46	0.44	0.46	0.01
Gizzard	3.78	3.72	3.76	0.13

[ab] Means within a row with different superscripts are significantly different (P<0.05)

Table 6: Effects of toasted *Icacinia manni* meal (TIMM) on haematological indices of the laying birds

	Dietary levels of TIMM			
Parameters	0%	10%	20%	SEM
Haemoglobin (Hb) estimate (g/dl)	8.7	8.17	8.75	1.73
Red blood cell (x 10^2/g)	6.80	6.80	8.83	0.74
White blood (x 10^3/g)	7.30	7.64	8.05	0.64
PCV (%)	37.40	31.82	34.13	2.41
Neutrophils (%)	33.20	35.12	32.06	1.73
Lymphocytes (%)	66.12	63.62	63.34	4.04
Eosinophils (%)	4.32[c]	2.22[b]	6.36[a]	0.17

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