ajava

Asian Journal of Animal and Veterinary Advances

Academic
Journals Inc.

www.academicjournals.com

Asian Journal of Animal and Veterinary Advances 4 (6): 326-331, 2009
ISSN 1683-9919

Effects of 5 h Wetting of Sun-Dried Cassava Tuber Meal on the Hydrocyanide Content and Dietary Value of the Meal for Laying Hens

G.E. Enyenihi, A.B.I. Udedibie, M.J. Akpan, O.L. Obasi and I.P. Solomon
Department of Animal Science, University of Uyo, Uyo, Akwa Ibom State, Nigeria

Abstract: The efficacy of wetting sun-dried cassava tuber meal as a method of reducing its hydrocyanide (HCN) content and improving its nutritive value for laying hens was investigated. Cassava tubers were peeled, chopped into pieces, sun-dried and then milled. Part of the Sun-dried Cassava Tuber Meal (SCTM) was soaked in water at the rate of 5 parts of water to 4 parts of the meal, thinly spread on the floor for 5 h and then taken out and sun-dried again. The Raw Cassava Tuber Meal (RCTM), Sun-dried Cassava Tuber Meal (SCTM) and Wetted Sun-dried Cassava Tuber Meal (WSCTM) were analyzed for HCN content. Five diets were made such that diet 1 (control) contained no cassava tuber meal; in diets 2 and 3, 50% of the maize in diet 1 was replaced with SCTM and WSCTM, respectively, while in diets 4 and 5, 100% of the maize was replaced with SCTM and WSCTM, respectively. Each diet was fed to a group of 24 laying hens for 12 weeks. At the end of the feeding trial, 4 birds were randomly selected from each group and used for determination of internal organ weights and haematological indices. Raw cassava tuber meal contained 800 ppm HCN, SCTM contained 50 ppm HCN while WSCTM contained 10 ppm HCN. The group on 100% WSCTM diet consumed significantly ($p<0.05$) less feed, gained least body weight and recorded least hen-day egg production, possibly due to very powdery nature of the diet. Egg weight and feed conversion ratio were not affected by the treatments ($p>0.05$). Egg quality indices were also not affected by the treatments ($p>0.05$). Internal organ weights were not affected by the treatments ($p>0.05$) but the birds on cassava diets recorded significantly ($p<0.05$) more abdominal fat. The birds on cassava diets also recorded significantly ($p<0.05$) less WBC and PCV values relative to the control group.

Key words: Sun-dried cassava tuber meal, wetted sun-dried cassava tuber meal, hydrocyanide, laying hens

INTRODUCTION

Nigeria is the world's largest producer of cassava with an estimated production of about 38.2 million metric tons in 2004 (FAO, 2005). With the current Federal Government emphasis on cassava production, it is expected that its production in Nigeria could double within the next few years. Most of the cassava produced is locally consumed as it is the staple food of the people. Attempts to use it as a source of energy in poultry diets as an alternative to maize have however not yielded encouraging results because of its content of cyanogenic glucosides (Odukwe, 1994; Udedibie *et al.*, 2004). Maize on the other hand has been playing a key role as a source of energy in poultry diets in the country. However, because maize is a major human food and also used for various industrial raw materials in the country, its demand outstrips its supply, leading to over 2000% increase in price within the last 20 years. This has invariably contributed to the high cost of poultry feeds with concomitant increase in the prices of poultry products.

Corresponding Author: A.B.I. Udedibie, Department of Animal Science and Technology, Federal University of Technology, P.M.B. 1526, Owerri, Nigeria

One method of processing cassava tubers for human consumption is sun-drying. Unfortunately, the traditional sun-drying method leaves a large amount of the cyanogenic glucoside, linamarin, remaining in the cassava flour, amounting to 25-33% retention of the cyanide (Bradbury, 2004). Recent studies in Australia (Bradbury, 2004) have, however, shown that wetting sun-dried cassava flour for 5 h at the ratio of 5 parts of water to 4 parts of the flour reduces its cyanide content to about 1/3 of its previous level and therefore makes it safe for human consumption. Follow-up studies in Nigeria (Udedibie *et al*., 2007; Udedibie and Asoluka, 2008) have also demonstrated that wetting sun-dried cassava tuber meal for 5 h reduced its HCN content to 1/5 of its previous level and improved its nutritive value as energy feed for broilers.

The study herein reported was designed to determine the effects of 5 h wetting of sun-dried cassava tuber meal on its value as source of energy in the diets of laying hens.

MATERIALS AND METHODS

The trial was carried out at the Poultry Unit of the Teaching and Research Farm of University of Uyo, Uyo-Akwa Ibom State, Nigeria.

Source and Processing of Cassava Tubers

The fresh cassava tubers (bitter variety) used for the study were bought from a local market in Uyo, Akwa Ibom State of Nigeria. They were peeled, chopped into small pieces and sun-dried until they became crispy. The sun-dried chips were then milled and sieved to produce Sun-dried Cassava Tuber Meal (SCTM). Half of the sun-dried cassava tuber meal was soaked in water at the ratio of 4 parts of the meal to 5 parts of water and then spread thinly on the floor and allowed to stand for 5 h at room temperature. Thereafter, the mash was re-dried in the sun and milled to produce wetted Sun-dried Cassava Tuber Meal (WSCTM). Samples of the Raw/fresh Cassava Tuber Meal (RCTM), Sun-dried Cassava Tuber Meal (SCTM) and Wetted Sun-dried Cassava Tuber Meal (WSCTM) were analyzed for HCN content, using the Picrate Paper kits method of Bradbury *et al.* (1999).

Experimental Diets

Five experimental laying diets were made such that diet 1 (control) contained no cassava tuber meal. In diets 2 and 3, 50% of the maize in the control diet was replaced with SCTM and WSCTM, respectively, while in diets 4 and 5, 100% of the maize was replaced with SCTM and WSCTM, respectively. Other ingredients were adjusted in such a way as to make the diets fairly isonitrogenous and iso-caloric. Ingredient composition and calculated chemical composition of the diets are shown in Table 1.

Experimental Birds and Design

One hundred and twenty laying hens at 2 months of laying life were divided into 5 groups of 24 birds each and each group randomly assigned to one of the 5 experimental diets in completely randomized design. Each group was further sub-divided into 4 replicates of 6 birds each and each replicate housed in a pen measuring 1½×1½ m with wood shavings as litter material. Feed and water were provided *ad libitum*. The trial lasted 12 weeks.

Data Collection

Data were collected on initial and final body weights, feed intake, feed conversion ratio, egg production, egg weights, egg qnality indices, internal organ weights and haematological indices of the birds.

The birds were weighed at the beginning and end of the trial to determine their body weight changes. Feed intake was determined by subtracting the weight of left-over feed from the weight of the

Table 1: Ingredient composition of the experimental diets

		Experimental diets			
		SCTM	WSCTM	SCTM	WSCTM
Ingredients (%)	Control	(50%)		(100%)	
Yellow maize	50.00	25.00	25.00	0.00	0.00
Cassava tuber meal	0.00	25.00	25.00	50.00	50.00
Soybean meal	16.00	17.00	17.00	18.00	18.00
Fish meal	2.50	4.00	4.00	5.00	5.00
Blood meal	1.50	2.00	2.00	2.00	2.00
Palm kernel cake	7.00	5.50	5.50	4.50	4.50
Wheat offal	12.00	11.00	11.00	10.00	10.00
Bone meal	5.00	5.00	5.00	5.00	5.00
Oyster shell	4.50	4.50	4.50	4.50	4.50
Common salt	0.25	0.25	0.25	0.25	0.25
TM/Vit. Premix*	0.25	0.25	0.25	0.25	0.25
L-lysine	0.25	0.25	0.25	0.25	0.25
L-methionine	0.25	0.25	0.25	0.25	0.25
Calculated chemical composition (% DM)					
Crude protein	17.57	17.63	17.63	17.24	17.24
Ether extract	3.53	2.91	2.91	1.97	1.97
Crude fibre	4.63	5.41	5.41	5.46	5.46
Ash	6.19	6.83	6.83	6.37	6.37
NFE	69.84	69.72	69.72	69.96	69.96
Calcium	3.71	3.93	3.93	4.00	4.00
Phosphorus	1.35	2.34	2.34	2.56	2.56
ME (Kcal g^{-1})	2.76	2.71	2.71	2.82	2.82

*To provide the following per kg of feed; Vitamin A: 10,000 iu; Vitamin D3: 1500 iu; Vitamin E: 3 iu; Vitamin K: 2 mg; Riboflavin: 3 mg; Pathothanic acid: 6 mg; Niacin: 15 mg; Vitamin B12: 8 mg; Choline: 350 mg; Folic acid: 4 mg; Mg: 56 mg; Iodine: 1.0 mg; Iron: 20 mg; Cu: 10 mg; Zn: 0.5 mg

feed fed the previous day. Eggs were collected twice daily. At the end of each week, the eggs from each pen were weighed to determine average egg weights. Feed conversion ratio was determined as kg feed intake per kg eggs produced. Hen-day egg production was determined by dividing total egg production by the total number of layers. Egg quality indices were determined accordingly: egg yolk index according to Funk (1948); albumen index according to Heiman and Carver (1936); Haugh unit 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 (one per replicate) and used for determination of the haematological indices and internal organ weights. They were weighed before they were killed by severing their necks from which about 2 mL of blood were carefully collected into labeled Bijon bottles containing EDTA as the anticoagulant. The blood samples were analyzed for Haemoglobin (Hb) level, Red Blood Cells (RBC), White Blood Cells (WBC), Packed Cell Volume (PCV), Mean Cell Haemoglobin Concentration (MCHC) and Mean Cell Volume (MCV) using the methods described by Monica (1984).

After the blood collection, the birds were de-feathered and eviscerated and their internal organs (liver, heart, gizzard and kidneys) as well as their abdomiual fat weighed and expressed as percent of dressed weight.

Statistical Analysis

Data generated were subjected to aualysis of variance (ANOVA) using SPSS (2004). Where ANOVA detected significant treatment effects, means were compared using New Duncan Multiple Range Test (NDMRT) as outlined by Obi (1990).

RESULTS AND DISCUSSION

Hydrogen Cyanide Content

The fresh raw cassava tuber contained 800 ppm HCN; the sun-dried cassava tuber meal contained 50 ppm HCN while the wetted sun-dried cassava tuber meal contained 10 ppm HCN. This meant

Table 2: Performance of the experimental birds

Parameters	Control	Experimental diets: SCTM (50%)	WSCTM (50%)	SCTM (100%)	WSCTM (100%)	SEM
Av. initial b.wt. (kg)	1.51	1.52	1.50	1.52	1.52	0.02
Av. final b.wt. (kg)	1.58	1.58	1.56	1.56	1.54	0.02
Av. b.wt. change (kg)	0.07^{a}	0.06^{a}	0.06^{a}	0.04^{ab}	0.02^{b}	0.006
Av. feed intake (g day^{-1})	114.6^{a}	116.2^{a}	115.7^{a}	113.9^{a}	107.9^{b}	1.56
Av. hen-day egg prod (%)	78.7^{a}	82.1^{a}	80.6^{a}	76.6^{ab}	75.6^{b}	2.09
Av. egg wt. (g)	56.9	54.0	55.3	54.5	55.1	0.80
Feed conversion ratio (kg feed/kg eggs)	2.02	2.11	2.09	2.09	1.96	0.05
Egg quality indices						
Haugh unit	26.40^{b}	50.12^{a}	39.20^{a}	52.16^{a}	50.42^{a}	4.02
Albumen index	0.07	0.08	0.07	0.12	0.10	0.016
Yolk index	0.47	0.40	0.42	0.44	0.44	0.10
Internal organ wts. (% of dressed wt.)						
Liver	4.20	3.86	4.48	4.02	4.53	0.45
Heart	0.70	0.80	0.80	0.71	0.83	0.06
Gizzard	3.47	3.77	3.25	3.19	3.31	0.20
Kidney	0.15	0.12	0.13	0.15	0.16	0.03
Abdominal fat	1.71^{b}	2.71^{a}	2.27^{a}	2.15^{a}	2.15^{a}	0.09
Haematological indices						
Hb (g 100 mL^{-1})	7.88	8.15	8.23	8.50	8.38	0.21
RBC (mm^{3})	2030^{a}	2170^{ab}	2040^{ab}	1770^{b}	2060^{ab}	130.3
WBC ($\times10^{9}$/g)	3.72^{a}	2.48^{b}	2.50^{b}	2.61^{b}	2.5801^{b}	0.08×10^{9}
PCV (%)	37.00^{a}	24.75^{b}	25.00^{b}	25.50^{b}	25.75^{b}	3.01
MCV (fl)	0.011^{b}	0.011^{b}	0.012^{ab}	0.015^{a}	0.013^{ab}	0.001
MCH (pg)	35.00^{b}	38.06^{b}	41.20^{ab}	50.16^{a}	41.11^{ab}	3.01

Means within a row with different superscripts are significantly different ($p<0.05$)

about 94% reduction in HCN by sun-drying and about 99% reduction when wetting process was applied. This result tended to confirm the earlier observation of Bradbury (2004) that wetting sun-dried cassava tuber meal as described above is a simple method that reduces HCN content of the meal to about 1/3 of the previous level. The reduction observed in this study was about 1/5 of the previous level which corresponds with the value recently reported by Udedibie and Asoluka (2008). The WHO safe standard for cyanide is 10 ppm (FAO/WHO, 1991). Wetting method therefore appears to be very effective as a method of processing cassava tubers for human consumption as well as a source of energy in poultry diets.

Performance of the Experimental Birds

Data on the performance of the laying hens are presented in Table 2.

Feed Intake and Body Weight Changes

The group on 100% WSCTM diet gained significantly ($p<0.05$) less body weight and consumed significantly ($p<0.05$) less feed. The poor body weight gain was believed to be due to the reduced feed intake by the group. The low feed intake was also believed to be due to the very powdery nature of the feed. Poor feed intake of birds on cassava flour diet had earlier been observed by various researchers (Tewe and Bokanga, 2001; Udedibie *et al*., 2004). Recent studies at our station (Udedibie *et al*., 2008) had shown no differences in feed intake of layers when cassava tuber meal was processed into pellets, confirming the observation that the powdery nature of the diet was responsible for the reduced feed intake.

Egg Production and Egg Weight

There were significant ($p<0.05$) differences in egg production among the groups. The group on 50% SCTM diet had the highest hen-day egg production, followed by the group on 50% WSCTM diet. Egg production of the groups on 100% SCTM and WSCTM diets were significantly ($p<0.05$) lower than that of the control group. Therefore, it appears that 100% replacement of dietary maize with sun-dried or wetted sun-dried cassava flour is not ideal for egg production.

There were no significant differences in egg weights among the treatment groups (p>0.05). There were also no significant differences in feed conversion ratio among the groups (p>0.05).

Egg Quality Indices

There were no significant differences among the groups in yolk and albumen indices (p>0.05). The control group, however, recorded significantly (p<0.05) lower Haugh unit. The reason for this was not clear. Egg shell thickness was also not effected by the treatments (p>0.05).

Organ Weights and Haematological Indices

The weights of the internal organs expressed as percent of dressed weight were not affected by the treatments (p>0.05). This tended to suggest that the cassava tuber meals were not toxic to the laying hens. Atuahene *et al*. (1986) and Bamgbose and Niba (1995) have associated significantly heavier liver weight of birds fed diets containing high levels of raw cottonseed meal with presence of toxic factor(s) in the diets. The birds on cassava-based diets however developed significantly (p<0.05) more abdominal fat than the control.

The treatments had no effect on haemoglobin concentration (p>0.05). The values were within the range of 7-18 g dL^{-1} recommended by Mitruka and Rawnslay (1977) as the normal values for chickens. The groups on cassava tuber diets had significantly (p<0.05) reduced WBC and PCV values relative to the control group. This seems to be in agreement with the earlier observation by Udedibie and Asoluka (2008) on broiler chickens. There were no observable trends in the values of MCHC and MCV. Haematological constituents usually reflect the physiological responsiveness of the animal to its external or internal enviroumnents and thus serve as a veritable tool for monitoring animal health. The haematological indices observed in this study are therefore indications that total replacement of dietary maize with sun-dried or wetted sun-dried cassava tuber meal had no serious deleterious effects on the internal physiology of the birds.

CONCLUSION

The study has revealed that sun-drying of cassava tubers and 5 h wetting of sun-dried cassava tuber meal can reduce the HCN content of the fresh cassava tuber meal by 94 and 99%, respectively. It would therefore follow that poor performance of animals fed diets based on such products would not be due to HCN content. The study has also shown that cassava tuber meal can replace 50% of the maize in the diets of laying hens if sun-dried. Even though wetting sun-dried cassava tuber meal eliminated almost all the HCN in the sun-dried cassava tuber meal, it did not attract any advantage over the sun-dried cassava tuber meal as source of energy in the diets of the laying hens. The relatively poor performance of the hens on 100% WSCTM diet was believed to be due to the dusty nature of the diet and not HCN, since the group on 50% SCTM diet relatively consumed more HCN.

Therefore, it is recommended that 50% of dietary maize for laying hens can be effectively replaced with sun-dried cassava tuber meal if the diet is balanced for protein in view of the disparity in crude protein content between maize and cassava. Higher replacements may need processing the cassava into pellets in view of the powdery nature of the diet at higher dietary cassava tuber meal.

REFERENCES

Atuahene, C.C., A. Don Koh and P. Nkansah-Dako, 1986. Effect 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 A.I. Niba, 1995. Carcass traits, relative organ weights and gut characteristics of broiler chickens fed cotton seed cake in starter and finisher rations. J. Anim. Prod. Res., 11: 68-73.

Bradbury, J.H., 2004. Wetting method to reduce cyanide content of cassava flour. Cassava Cyanide Diseases Network News, 4: 3-4.

Bradbury, M.E., S.V. Egan and J.H. Bradbur, 1999. Picrate paper kits for determination of total cyanogens in cassava products. J. Sci. Food. Agric., 79: 595-601.

Brant, A.W., A.W. Otte and A.T. Norris, 1951. Recommended standards for scoring and measuring opened egg quality. Food Tech., 5: 356-361.

FAO, 2005. Food and agricultural organization of the United Nations. Production Year Book, FAO, Rome.

FAO/WHO, 1991. Joint FAO/WHO feed standards programme. Codex Alimentarius Commission, FAO, Rome.

Funk, E.M., 1948. The relation of the yolk index determination in the natural position to the yolk index as determined by separating the yolk from the albumen. Poult. Sci., 27: 367-367.

Haugh, R.R., 1937. The Haugh unit for measuring egg quality. US Egg Poul. Mag., 43: 552-555.

Heiman, V. and T.S. Carver, 1936. The albumen index as a physical measurement of egg quality. Poult. Sci., 15: 141-148.

Mitruka, B.M. and H.M. Rawnsley, 1977. Clinical Biochemistry and Haematological References Values in Normal Experimental Animals. Masson, New-York, pp: 54-55.

Monica, C., 1984. Medical Lab. Manual for Tropical Countries. Tropical Health Technology, Cambridge.

Obi, I.U., 1990. Statistical Methods of Detecting Differences between Treatment Means. 2nd Edn., Snaap Press, Enugu, Nigeria, pp: 24-35.

Odukwe, C.A., 1994. The feeding value of composite cassava root meal for broiler chickens. Ph.D. Thesis, University of Nigeria, Nsukka-Nigeria.

SPSS, 2004. Statistical Package for Social Sciences. Procedure and Facilities for Release. McGraw Hill Book Co., New York.

Tewe, O.O. and M. Bokanga, 2001. Cost effective cassava plant-based rations for poultry and pigs. Proceedings of the ISTRC, African Branch (IITA), Nov. 10-11, Ibadan, Nigeria, pp: 324-329.

Udedibie, A.B.I., B.C. Anyaegbu, G.C. Onyeckwu and O.C. Egbuokporo, 2004. Effect of feeding different levels of fermented and unfermented cassava tuber meals on the performance of broilers. Nig. J. Anim. Prod., 31: 211-219.

Udedibie, A.B.I., I.L. Alozie and H.I. Duru, 2007. Effect of 12-hour wetting of sun-dried cassava tuber meal on its HCN content, performance and haematological indices of broiler chicks. Anim. Prod. Res. Adv., 3: 1-5.

Udedibie, A.B.I. and O.C. Asoluka, 2008. Effects of 5-hour wetting of sun-dried cassava tuber meal on the HCN content and dietary value of the meal for young broiler chicks. Nig. J. Anim. Prod., 35: 25-31.

Udedibie, A.B.I., G.E. Enyenihi, M.J. Akpan, I.P. Solomon and O.L. Obasi, 2008. Physical/chemical quality and nutritive value of dried cassava fufu meal for laying hens. Proceedings of the 33rd Annual Conference Nigerian Society Animal Production, 2008, IEEE Xplore London, pp: 399-401.