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Effect of Hydrocyanic Acid Intake on Sensory Properties of Broiler Meat

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Abstract: A study was conducted to evaluate the sensory properties of meat obtained from broilers fed different levels of Cassava Flour Meal (CFM). Cassava Flour Meal was used to substitute maize at 0, 20 and 40% level. It was discovered that the weekly intake of 75.96mg /100g and 225.31mg/100g of Hydrocyanic Acid (HCN) significantly ($p<0.05$) led to an increase in cooking losses and a corresponding decrease in the cooking yield of meat obtained from birds fed HCN. The intake of HCN also affected ($p<0.05$) tenderness, juiciness and palatability in birds fed cassava flour meal based diets. It was concluded that the intake of HCN had a negative effect on the sensory parameters measured and that this effect is most felt in birds fed above 124.23 mg /100g of HCN.

Key words: Sensory properties, broiler meat, intake, hydrocyanic acid

Introduction

The major reason for rearing broilers is to produce birds that will provide a ready source of meat for human consumption. The meat so produced is expected to be of good quality and appealing to the consumers. Measure of meat quality includes such indices as tenderness, palatability, aroma, flavour, colour and juiciness. Specie, sex, breed, age and post-mortem handling are also known to influence these factors. It is also possible that diet or some components of diet may exert some effects on the factors enumerated above. Such effects may lead to the spoilage of the meat or reduce the quality in the eyes of consumers leading to low pricing.

Cassava is a common root and tuber crop (FAO, 1996), which is gradually gaining prominence as a source of feed ingredient in the livestock sector of most economies in developing countries. It represents a great potential especially in Nigeria which is the world's leading producer of the crop (IITA, 1998) producing in excess of 33 million metric tonnes per year (Ikwelle, 1999). Its ability to adapt to different soil type is also an advantage meaning it can be grown all over the country. Cassava finds usage in livestock feed principally because of its high energy value (Stevenson and Jackson, 1983; Tion and Adeka, 2000), which makes it a suitable substitute for the more expensive maize, the main energy source in most monogastric feeds.

In spite of all these advantages, the usage of cassava (its stem, leaves and root) is generally plagued by its high content of HCN. HCN is a chemical known to affect digestion, growth rate and other performance characteristics (Esonu and Udedibie, 1993; IITA, 1997; Stephen, 2003) in poultry and other farm animals. It is also known to affect certain haematological indices in broilers (Stephen and Ayanwale, 2003). The objective of this study is to investigate the effect of HCN consumption on sensory properties of broilers fed cassava flour based meal.

Materials and Methods

Source of material: Fermented cassava flour used for the study was purchased from Minna central market while 135 day old chicks (Ross breed) were obtained from ECWA Rural Development Limited also in Minna, Niger State, Nigeria. Wood shavings were obtained from saw millers; vaccines and other medications were purchased from Agro veterinary stores also in Minna.

Formulation of diet: Fermented cassava flour was used in formulating three diets. It was used to substitute maize at three levels of inclusion: 0, 20 and 40%.

Management of experimental birds: The chicks on arrival were weighed and randomly allotted into three treatments groups of three replicates in a Complete Randomized Design (CRD). This represents 45 birds per treatment and 15 birds per replicate. Wood shavings were used as bedding material and the house was electrically heated using 60 watt bulbs. All necessary sanitary precautions were undertaken. The birds were given glucose solution as energy boost and anti-stress (V and E plus® and Vitalyte®). Feed and water were given *ad libitum* throughout the experimental period. The birds were vaccinated against Gumboro, Coccidiosis and Newcastle disease.

Sensory evaluation: A total of 18 birds, 2 birds per replicate, were selected and used for carcass evaluation. The birds so selected were fasted over night and killed by neck dislocation. Thereafter, the jugular vein was severed and then bled. They were then scalded

Table 1: Dietary composition of experimental diets

	Dietary cassava levels (%)		
Ingredients	0	20	40
Maize	48.00	28.00	8.00
Groundnut cake	37.00	37.00	37.00
Cassava flour meal	=	20.00	40.00
Palm oil	5.00	5.00	5.00
Fish meal	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00
Rice husk	1.50	1.50	1.50
Limestone	1.65	1.65	1.65
Salt	0.20	0.20	0.20
Methionine	0.20	0.20	0.20
Lysine	0.20	0.20	0.20
Premix*	0.25	0.25	0.25
Total	100.00	100.00	100.00
Calculated %CP	22.90	22.00	21.44
Calculated energy (Kcal Kg⁻1)	3077.00	3063.00	3031.00

*2.5 kg of premix contains: Retinol acetate (100000001 u), Vit. D_3 (20000001 u), Vit. E (150001 u), Vit.B (3000 mg), Niacin (15000 mg), Calcium pantothenate (800 mg), Vit. B_6 (3000 mg), Vit.B_{12} (10 mg), Vit. K_3 (2000 mg), Biotin (20 mg), Folic Acid (500 mg), Choline chloride (250000 mg), Manganese (75000 mg), Iron (25000 mg), Copper (5000 mg), Zinc (70000 mg), Selenium (150 mg), Iodine (1300 mg), Magnesium (100 mg), 500 g ethoxyquin and BHT (700 g)

Table 2: Chemical composition of cassava flour meal

Components	(%)
Dry matter	85.6
Crude protein	2.0
Crude fibre	4.4
Ether extracts	2.0
Ash	5.1
Nitrogen free extracts	72.1
HCN (mg $100g^{-1}$)	7.3

and defeathered. Some quantity of the flesh were collected and used to carry out a test to ascertain the cooking loss or yield according to the method of Awonorin and Ayoade (1992). It involved taking samples from each replicate, which were weighed before cooking for 15 min without salt. The samples were collected and blotted with blotting paper. The samples were reweighed again to determine losses or gain. Ten untrained scorers were selected randomly and used to test for palatability, tenderness and juiciness on a five point descriptive scale (with 1 = not tender, not juicy and not palatable; and 5 = very tender, very juicy and very palatable). Each scorer after tasting the meat sample from a particular treatment group recorded the score and rinsed his/her mouth with water before tasting another meat sample from another treatment group.

The pH of the meat was measured using a combined pH and temperature meter (Rex model pHS-25).

Analysis of the test material: The test material (CFM) was analyzed for dry matter, crude protein, crude fibre, ether extracts, ash, nitrogen free extracts and HCN content using the method of AOAC (2000).

Table 3: Mean HCN intake by broilers fed cassava flour meal based diets at starter and finisher phases (mg $100g^{-1}$)

Age (weeks)	T_1	T_2	T_3	SEM
Starter phase				
1	0	12.41	26.99	
2	0	32.57	59.44	
3	0	53.11	99.76	
4	0	80.17	117.64	
Total	0	178.26	303.83	
Mean	0^c	44.57^b	75.96^a	6.84*
Finisher phase				
5	0	88.63	142.93	
6	0	103.15	212.40	
7	0	122.49	270.20	
8	0	143.45	238.87	
9	0	163.42	262.16	
Total	0	621.14	1126.56	
Mean	0^c	124.23^b	225.31^a	14.85*

*Means in the same row denoted by different alphabets are significantly different (p<0.05)

Data analysis: Data obtained were subjected to statistical analysis by the method of (Minitab, 1992) and where significant differences exist (p<0.05), means were separated using the method of Duncan (1955).

Results and Discussion

Table 2 shows the chemical composition of the CFM used for the experiment. From the result, it can be seen that it is low in protein, ash, fibre content and ether extract. It is equally low in HCN content. Its dry matter and carbohydrate content is however quite high.

Table 3 illustrates the mean HCN intake by the birds during the experimental period. It showed a progressive increase in HCN level as cassava flour meal increased in the diet. It equally showed a progressive increase in HCN intake by the birds as the experiment progressed. The highest (p<0.05) intake of HCN was recorded for birds fed diet 3 (40% inclusion), followed by those fed diet 2 (20% inclusion).

Table 4 shows the cooking yield, cooking loss and pH of the meat. There was a progressive decrease (p<0.05) observed in cooking yield and a corresponding increase (p<0.05) in cooking loss percentages in the meat with increasing level of HCN intake by the birds. The pH followed the same trend although no significant effect (p>0.05) was observed as a result of the consumption of the treatment diets. Birds fed diet 3, which had the highest HCN content, had the lowest cooking yield and hence, the highest cooking loss. It might be that high intake of HCN led to a decrease in the water holding capacity of the meat muscle protein and this effect was highest in birds fed diet 3. This could be due to a higher rate of muscle protein denaturation in birds fed the diet. This is in agreement with Rogers *et al.* (1967) who stated that changes in the myofibrillar protein as a result

Table 4: Cooking yield, cooking loss and pH of meat obtained from broilers fed cassava flour meal based diets (%)

Parameter	T_1	T_2	T_3	SEM
Cooking yield	65.39[a]	62.79[ab]	62.10[bc]	0.71*
Cooking loss	34.61[a]	37.21[ab]	37.97[bc]	0.70*
pH	5.10	5.90	5.07	0.01ns

*Means denoted by different alphabets along the same row are significantly different (p<0.05), ns = not significant (p>0.05)

Table 5: Mean score for meat by panelist

Parameter	T_1	T_2	T_3	SEM
Tenderness	4.67[a]	4.46[a]	4.00[b]	0.18*
Juiciness	5.00	4.65	4.50	0.01ns
Palatability	4.67[a]	4.55[a]	4.00[b]	0.18*

*Means denoted by different alphabets are significantly different (p<0.05) ns = not significant (p>0.05)

of increase in temperature causes shrinkage of the meat tissue leading to the release of juices. The loss of juice could also be attributed to the low pH values especially in birds fed cassava flour based diets. As pH falls, the actomysin linkage intensifies promoting the passage of the meat from a gel to a more compact crystalline structure resulting in a reduction in water holding capacity (Alais and Linden, 1999).

Table 5 shows the mean score obtained for meat by the panelist. It was observed that tenderness and palatability were depressed ($p<0.05$) in the birds fed cassava flour meal based diets. Birds fed diet 3 (40% inclusion) had lower values for both indices compared to birds fed diet 2 (20% inclusion) and the control diet (0% inclusion). This reduction in tenderness and palatability of the meat is to be expected as a loss in nutrients and water will lead to the meat being less tender, less juicy and less tasty as evidenced in birds fed diet 3.

Although juiciness was not affected ($p>0.05$), the values obtained showed a decrease with increase in HCN intake by the birds. Meat obtained from birds fed diet 2 was juicer, tenderer and more palatable when compared to those obtained from birds fed diet 3.This is an indication that HCN did not seriously affect these indices at that level (20% inclusion). It is also possible that HCN did not affect fat deposition in the birds fed diet 2 as they approached market weight. This might have had an improving effect on palatability and tenderness brought about by the presence of aromatic compounds in the meat. This upholds the result of Aremu (2003), which stated that tenderness might be as a result of more fat deposition in birds. The variation in juiciness, palatability and tenderness shows that the trend is dependent on the diets fed to the birds.

Conclusion: HCN consumption had an effect on the sensory properties measured and this effect was most felt in birds fed above 124.23 mg $100g^{-1}$. It is therefore recommended that HCN should not be fed above that level for better appreciation of poultry meat obtained from broilers fed cassava based diets.

References

Alais, C. and G. Linden, 1999. Food biochemistry. Aspen publishers. Maryland, USA.

AOAC, 2000. Official methods of analysis. Association of Official Analytical Chemist. 17th edition. Washington, DC.

Aremu, A., 2003. Sensory evaluation of market weight poultry birds as influenced by species and consumer preference. Proceedings of the 8th Annual Conference of Animal Science Association of Nigeria. September 16th-18th, pp: 44-46.

Awonorin, S.O. and J.A. Ayoade, 1992. Texture and eating quality of raw and thawed roasted turkey and chicken breast as influenced by age of birds and period of frozen storage. J. Food service system, 6: 214-255.

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

Esonu, O.O. and A.B.J. Udedibie, 1993. The effect of replacing maize with cassava peel meal on the performance of weaner rabbits. Nig. J. Anim. Product., 20: 31-35.

FAO, 1996. Food outlook. Food Agri. Organization, pp: 19-32.

IITA, 1997. Annual report of International Institute of Trop. Agri. Ibadan, Nig., pp: 12-13.

IITA, 1998. Annual report of International Institute of Trop. Agri. Ibadan, Nig., pp: 20-22.

Ikwelle, M., 1999. Director's keynote address. Annual review and planning workshop of the National Root Crop Research Institute Umudike, Abia State, Nigeria.

Minitab, 1992. Minitab for windows release 9.2. Statistical package.

Rogers, P.J., G.E. Goertz and D.L. Harrison, 1967. Heat induced changes of moisture in turkey muscles. J. Food Sci., 32: 298-304.

Stephen, S., 2003. Biochemical evaluation of cassava flour meal in broiler diets. Unpublished MTECH thesis. Federal University of Technology Minna, Niger State, Nigeria.

Stephen, S. and B.A. Ayanwale, 2003. Effect of different hydrocyanic acid consumption on haematological values in broilers. Proceedings of the 8th Annual Conference of Animal Science Association of Nigeria. September 16th-18th, pp: 183-184.

Stevenson, M.H. and N. Jackson, 1983. The nutritional value of dried cassava root meal in broiler diets. J. Sci. Food Agri., 34: 1361-1367.

Tion, M.A. and I. Adeka, 2000. Evaluation of cassava root meal as a replacement for maize in broiler diets. Proceedings of the 25th Annual Conference of Nigerian Society for Animal Production. Umudike, Abia State, Nigeria, pp: 19-23.