PHYSICAL ATTRIBUTES OF MEAT FROM BROILER CHICKENS FED DIETS WITH VARYING INCLUSION LEVELS OF CASSAVA (*Manihot esculenta* Crantz) PEAL MEAL

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ABSTRACT

The physical properties of meat from broiler chickens fed diets based on four cassava peel products were investigated using ten-day old Ross 308 broiler chickens (n=455). The chicks were randomly allotted to 13 treatments of 35 broilers each. Each treatment was replicated five times and a replicate comprised seven chicks. Sundried cassava peel meal (SCPM), whole cassava peel mash (WCPM), fine cassava peel mash (FCPM) and coarse cassava peel mash (CCPM) each replaced dietary maize at 20, 40 and 60% level while the last diet was a maize-based diet. The chicks were fed the respective grower and finisher experimental diet for 10-24 and 24-26 days, respectively. Meat were harvested from the chicken and assessed for physical parameters. Results showed that cooking loss, water holding capacity, thermal shortening, colour, flavour, texture, tenderness, juiciness and overall acceptability were significantly influenced ($P<0.05$) by replacement of maize with the cassava peel products. The cooking loss, water holding capacity, thermal shortening were highest in 40% SCPM (22.00%), 20% FCPM (79.81%) and 40% CCPM (39.00%), respectively. Meat colour, flavour, texture, juiciness and overall acceptability in 60% CCPM (8.50), 40% CCPM (8.50), 20% FCPM (8.00), control (7.00) and 20% WCPM (8.50) were the highest. Meat from birds on control (7.50) and 20%WCPM (7.50) had the highest tenderness score. It was concluded that cassava peel products could be an attractive option in broiler feed, however, the choice and dietary inclusion levels of the products should be dependent on expectations in the meat physical attributes.

Keywords: Cassava peel, High-Quality Cassava peel mash, Meat attributes, organoleptic

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INTRODUCTION

There is a growing demand for poultry product due to the rapid growth in human population. Cakmak (2002) estimated that world population would have grown to 10 billion by the year 2050. Oloyede (2005) also observed that 41-54% of the minimum protein requirement of adult is expected to be sourced from animal protein. One of such source of protein is broiler meat. Production of broiler meat will put pressure on the already scarce and sometimes costlier maize. Maize is an important ingredient required in the formulation of high energy diet required by fast-growing broiler chicken meat production.

There is an increased search for alternatives that could partially or totally replace maize in broiler chicken feed and products. Cassava grit, acha, and cassava peel meal have been considered as suitable alternatives (Salami and Odunsi, 2003; Ogunwole *et al.,* 2016*;* Wumnokol *et al.,* 2019). Cassava peel, which is obtained from generous peeling of cassava tuber could, however, be a viable alternative to maize due to less competition for cassava peel by humans as food, relative to alternatives. The cyanide scare and challenges associated with usage of cassava peel in livestock has led to the deployment of processing methods such as sun-drying, soaking and fermentation (Udedibia *et al.,* 2004; Aniebo, 2012; Oladimeji *et al.,* 2019) with various degree of success.

Subjecting cassava peel to various physical treatment could ensure high quality product that is low in aflatoxin and could be used in poultry feed (Okike *et al.,* 2015; Oladimeji *et al.,* 2019). Though Oladimeji *et al.* (2019) reported on the carcass characteristics of the broiler chicken fed cassava peel products, however, there is also the need to determine the physical attributes of meat from broiler

chickens' when fed diets with varying inclusion levels of cassava (*Manihot esculenta* Crantz) peel meal, which is the aim of this study.

MATERIAL AND METHODS

Test materials

Cassava peel products used for the study were obtained from freshly peeled cassava tuber after which one part was sundried till constant weight was attained and named sundried cassava peel meal (SCPM). Other products, namely whole cassava peel mash (WCPM), fine cassava peel mash (FCPM) and coarse cassava peel mash (CCPM) were obtained using the method of Okike *et al.* (2015) as modified Oladimeji *et al.* (2019)

Experimental Animal

Ten-day old Ross 308 broiler chickens (n=455) were used for the study. They were obtained at 1-day old and raised on commercial feed for ten days after which they were randomly allotted to 13 dietary treatments. Each treatment was replicated five times. Each replicates comprised seven chicks. The chicks were offered feed and water *ad-libitum* throughout the period of the study.

Experimental Diets

Thirteen iso-caloric and iso-nitrogenous diets were formulated for the grower and finisher chickens. The cassava peel products SCPM, WCPM, FCPM and CCPM were used to replace 20, 40 and 60% dietary maize in the control diet. Details of the basal experimental formulation have been documented (Oladimeji *et al.*, 2019), the metabolizable energy and crude protein of the grower was 3050.5 Kcal/Kg and 20.9% while finisher was 3103.9 Kcal/Kg and 19.51% respectively. Grower diets were offered from day 10 to 24 and the finisher from day 24 to 46.

Meat analyses

At day 46 of the experiment, two chickens per replicate with body weights closest to the group average weight were selected, tagged and starved of feed over-night. The chickens were subsequently sacrificed by severing the jugular vein and allowed to bleed after which they were de-feathered and properly dissected. The breast meats were afterwards harvested for cooking loss **(**Omojola and Adesehinwa, 2007), water holding capacity (Hamm, 1986) and thermal shortening (Allen *et al.*, 1998)

Organoleptic Studies

Twenty semi-trained individuals aged between 24 to 30 years were used to assess four replicate of prepared meat sample from the birds fed the 13 different dietary treatments. The samples were evaluated using a nine-point hedonic scale for flavour, colour, juiciness, tenderness and overall acceptability according to the procedure of Cross *et al.* (1986). The evaluation of each meat samples was independent of each other. The poorest condition was scored 1 and the best 9.

Experimental Design

The experimental design was a 1+(4x3) augmented factorial arrangement in a completely randomized design. Data were subjected to analysis of variance using SAS (2002) while means were separated at $\alpha_{0.05}$.

RESULTS AND DISCUSSION

The effect of varying inclusion levels of cassava peel products on physical properties of meat of broiler chickens were presented in Tables 1 and 2. Results showed a significant effect of replacement of maize with all the test cassava peel products on the physical properties evaluated. Cooking loss is a measure of juiciness of meat sample (Bertram *et al.*, 2004). Broiler on 40% SCPM (22.00%) recorded the highest ($P<0.05$) cooking loss while those on 60% FCPM (7.00%) were least. The higher the cooking loss the more juicy the meat. Water holding capacity (WHC) is a measure of ability of meat to retain moisture, meat from broilers on 20% FCPM (79.81%) had the highest WHC ($P<0.05$) while those on 60% SCPM (60.03%) had the least. The thermal shortening of meat from birds on 40% CCPM (39.00%) was highest.

The meat colour of birds on 60% WCPM (8.50) was significantly higher ($P<0.05$). Kartika *et al.* (2016) submitted that meat colour is dependent on the myoglobin type, chemical and physical state of

component of meat. The meat of chickens on 40% SCPM had the highest flavour score (8.50) while those on 60% SCPM (4.50), 40% CCPM (4.00), 40% WCPM (4.50) and 40% FCPM were the least. The texture of the meat from broiler on 20% FCPM (8.00) had the highest score while those on 40% SCPM (4.50), 60% SCPM (5.00), 40% FCPM (5.00) and 60% FCPM (5.00) had the least score.

Table 1: Effect of graded dietary inclusion levels of cassava peel products on physical characteristics of meat of broiler chickens (%)

Cassava Peel Product	Inclusion level	Cooking loss (%)	Water holding capacity (%)	Thermal Shortening (%)
Control	0	12.00^{cd}	76.56^{ab}	27.00^{cdef}
Sundried	20	14.00^{bc}	71.84^{abc}	20.00^{f}
	40	22.00^{a}	69.16^{abc}	31.00^{bcd}
	60	13.00^{c}	60.03^{c}	36.00^{ab}
Coarse	20	19.00^{ab}	73.80^{abc}	22.00^{ef}
	40	19.00^{ab}	60.72^{c}	39.00^{a}
	60	16.00^{bc}	63.93^{bc}	28.00^{cde}
Whole	20	11.00^{cd}	66.59^{abc}	29.00^{bcde}
	40	15.00^{bc}	74.64^{abc}	25.00^{def}
	60	14.00^{bc}	64.38^{abc}	31.00^{bcd}
Fine	20	12.00^{cd}	79.81^{a}	27.00^{cdef}
	40	12.00^{cd}	78.60^{ab}	31.00^{bcd}
	60	7.00^{d}	68.15^{abc}	33.00^{abc}
	SEM	0.74	1.48	0.96

^{abc} Means with the same superscripts in the same column are not significantly different (P>0.05) SEM= Standard error of mean

Table 2: Effect of interactions of cassava peel products and inclusion levels on organoleptic properties of meat from broiler chickens

Cassava Peel Product	Inclusion level	Colour	Flavour	Texture	Tenderness	Juiciness	Overall acceptability
Control	0	6.50^{bcd}	6.00^{bc}	6.00^{ab}	7.50^{a}	7.00^{a}	7.00^{abcd}
Sundried	20	3.00^{g}	7.00^{b}	5.50^{ab}	5.50^{ab}	2.50^{c}	6.50^{bcd}
	40	7.00^{bc}	8.50^{a}	4.50^{b}	5.50^{ab}	4.50^{bc}	7.00^{abcd}
	60	6.00^{cde}	4.50^{d}	5.00^{b}	5.00^{b}	6.50^{ab}	6.50^{bcd}
Coarse	20	6.00^{cde}	5.00^{cd}	6.00^{ab}	6.00^{ab}	6.50^{ab}	6.00^{dc}
	40	5.00^{ef}	4.00^{d}	7.00^{ab}	4.50^{b}	6.50^{ab}	5.50^{d}
	60	8.50^{a}	7.00^{b}	6.50^{ab}	6.00^{ab}	5.00^{ab}	7.00^{abcd}
Whole	20	7.50^{ab}	7.00^{b}	5.50^{ab}	7.50^{a}	7.00^{a}	8.50^{a}
	40	4.50^{f}	4.50^{d}	5.50^{ab}	5.50^{ab}	5.00^{ab}	6.50^{bcd}
	60	5.50^{def}	6.00^{bc}	6.50^{ab}	4.50^{b}	5.00^{ab}	6.00^{cd}
Fine	20	7.00^{bc}	5.00^{cd}	8.00^{a}	5.00^{b}	6.50^{ab}	8.00^{ab}
	40	7.00^{bc}	4.00^{d}	5.00^{b}	6.50^{ab}	5.50^{ab}	7.50^{abc}
	60	7.50^{ab}	5.00^{cd}	5.00^{b}	4.50^{b}	6.00^{ab}	6.50^{bcd}
SEM		0.25	0.24	0.24	0.22	0.25	0.18

^{abc} Means with the same superscripts in the same column are not significantly different (P>0.05) SEM= Standard error of mean

Tenderness of meat from chickens on control diets (7.50), 20% WCPM (7.50) as well as the juiciness of those on the control (7.00), 20% WCPM (7.00) were the highest. Sensitivity of the mouth, texture of meat, meat water holding capacity and fat content could have contributed to the observed differences (P<0.05) in the tenderness and juiciness of the meat, as they play an important role to

lubrication when chewing (Juarez *et al.*, 2015). Cross *et al.* (1986) reported that meat is directly related to intramuscular lipid and moisture content which was corroborated by Omojola and Adesshinwa (2007) that the combination of water and melted lipids form broth which are retained in the meat and released when chewed. The overall acceptability of meat from birds on 20% WCPM (8.50) was highest and least in those on 40% CCPM (5.50). The fibrous nature of coarse cassava peel mash perhaps contributed to lower meat acceptability recorded by broiler on 40% CCPM.

CONCLUSION AND RECOMMENDATION

Cassava peel products could be a viable alternative to maize in broiler feed, however, choice of products and replacement level for inclusion should be based on the expected use of the meat.

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REFERENCES

Allen C. D., Russell S. M., and Fletcher D. L. (1997).The Relationship of Broiler Breast Meat Colour and pH to Shelf-Life and Odour Development. *Poultry Science Journal* 76, 1042–1046.

Aniebo A.O. (2012). Appraisal of palm oil and methionine as detoxifying agents of residual cyanide in cassava-based broiler starter diets. *International Journal of Food, Agriculture and Veterinary Sciences.* 2(1), 153-161.

Bertram H. C., Engelsen S. B., Busk H., Karlssona A. H., Andersen H. J. (2004). Water properties during cooking of pork studies by low-field NMR relaxation: Effects of curing and the RN-gene. *Meat Sci.* 66:437-446.

Cakmak, I. (2002). Plant nutrition research: Priorities to meet human needs for food in sustainable ways. *Plant and Soil* 247, 3–24 (2002) DOI:10.1023/A:1021194511492.

Cross H. R. and Overby A. J. (1986). World animal science-B3, meat science, milk science tech, Elsevier science publishers, Amsterdam, The Netherland. Dave's Garden.

Hamm, R. (1986). Functional properties of the myofibrillar system and their measurements. *In P. J. Bechtel (Ed.), Muscle as food* (pp. 135–199). New York: Academic Press, Inc.

Juárez M, Aldai N., López-Campos Ó., Dugan M.E.R., Uttaro B., and Aalhus J.L. (2015) Beef texture and juiciness. Handbook of Meat and Meat Processing, Second Ed. 9: 177-205

Karthika, S., Chandirasekaran, V. and Sureshkumar S. ., Sensory attributes of Namakkal Quail-1 meat. International Journal of Advanced Veterinary Science and Technology, 2016, 5(2), 266-269.

Ogunwole O. A., Idowu, A. I., Olumide, M. D., Lawal, H. O., Oladimeji S. O., Abayomi, F. D. and O. O. Tewe. (2016). Calcium and Phosphorus Utilization by Broiler Chickens Fed β-Carotene Biofortified Cassava (*Manihot Esculenta* Crantz) Grits Based Diets. *Ibadan Journal of Agricultural Research*; Vol. 12 (1).

Okike I., A. Samireddypalle, L.Kaptoge, C. Fauquet, J. Atehnkeng, R.Bandyopadhyay, P.Kulakow, A. Duncan, T. Alabi, and M. Blummel. (2015). Technical innovations for small-scale producers and households to process wet cassava peels into high-quality animal feed ingredients andaflasafe™ substrate. *Food chain* 5(1-2):71-90.

Oladimeji S. O., Ogunwole O. A., Amole T. A. and Tewe O. O. (2019). Carcass characteristics and organ weights of broiler chickens fed varying inclusion levels of cassava *(Manihot esculenta* Crantz) peel based diets. Proceedings of the 8th ASAN-NIAS Joint Annual Meeting, September 8-12, 2019. pp 147-154.

Oloyede, H. O. B. (2005). All for the love of nutrients, The 78th Inaugural lecture, Library and Publication Committee, University of Ilorin.

Omojola, A. B. and Adesehinwa, A. O. K. (2007). Performance and carcass characteristics of broiler chickens fed diets supplemented with graded levels of Roxayme G®. *International Journal of Poultry Science.* 6 (5):335-339.

Salami, R. I. and Odunsi, A. A. (2003). Evaluation of processed cassava peel meals as substitutes for maize in the diets of layers. *International Journal of Poultry Science* 2 (2): 112-116.

SAS Institute, Inc. (2002). SAS language: reference, Version 6, 1st Edition. SAS Institute Inc., Cary, North Carolina. USA.

Udedibie A. B. I., Anyaegbu B. C., Onyechekwa G. C. and Egbuokporo O. R. (2004). Effect of feeding different levels of fermented and unfermented cassava tuber meals on performance of broilers. *Nigerian Journal of Animal Production* 31(2004), 211-219.

Wumnokol, D.P., Guluwa, L. Y. and Latu, M. Y. (2019). Performance and haematology of broiler starter fed acha (*Digitaria exilis* Staph) grains as replacement for maize. *NJAP*. 46 (2); 87-91.