EFFECT OF PELLETIZED CASSAVA PEEL -BASED DIETS ON HAEMATOLOGICAL PARAMETERS OF BROILER STARTER CHICKENS

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ABSTRACT
This study investigates the haematological response of broiler chickens to varied levels of cassava peel as a replacement for maize. Three experimental diets were formulated; T1 (0% cassava peel), T2 (10% cassava peel inclusion) and T3 (20% cassava peel inclusion) respectively. At the end of the feeding trial, 2ml blood samples were collected from 3 broilers per treatment into plastic tubes containing the anti-coagulant ethylene diamine tetra-acetic acid (EDTA) for the determination of haematological parameters (PCV, Hb, RBC, WBC, MCHC, MCH and MCV). Data collected on the blood parameters of broilers fed the experimental diets were subjected to One-way Analysis of Variance (ANOVA) using general linear model (GLM) procedure of SAS 0.13. The results showed normal range of blood values: PCV-36.50-37.50 %; Hb-12.10-13.30 g/dl; RBC-2.6x10^6/mm^3; WBC-5.00-9.15x10^3; MCV-14.05-15.30 fl; MCHC-3.30-3.40 % and MCH-4.63-5.10 pg recommended for healthy birds. From the results of this study, cassava peel replacement at varying levels with maize can serve as an alternative energy source in broiler feed, without any adverse effects on the haematological responses of broilers.
Keywords: Pelletized Cassava peel, Haematology, Broiler starter.

INTRODUCTION

Cassava (*Manihot esculenta*) represents a significant human food resource and, in many regions, an underutilized animal feed ingredient on a worldwide scale. It has been extensively cultivated as an animal crop in tropical and subtropical regions for its edible underground tuberous root, acknowledged as one of the highest yielders of starch and third largest source of food carbohydrates in the tropics, following rice and maize (Lukuyu *et al*, 2014). For instance, cassava has been described as a major staple for in the developing world, providing a base diet for over 800 million people (Lebot, 2009). Cassava peels are the outer protective layers of the cassava root, consisting of the skin and the fibrous under layer. These peels are rich in carbohydrates, primarily in starch, and contain varying levels of proteins, fibres, vitamins, and minerals. However, they also contain anti-nutritional factors, including cyanogenic glycosides, which can be toxic to animals if ingested in large quantities (Akinfala *et al,* 2002). Studies by Kana *et al.* (2012) evaluated the effect of cassava meal supplemented with a combination of palm oil and cocoa husk as alternative energy source on broiler growth and reported that substituting up to 75% of maize with cassava meal supplements with mixture of palm oil and cocoa musk seems profitable for productive performances (Nwokoro and Ekhosuehi, 2005).

Broiler chicken are typically characterized by their fast growth rate and efficient conversion of feed into muscle tissue (Moran, 2007). The process involved crossbreeding different chicken breeds to enhance growth rate, feed efficiency, and muscle development. Broiler chickens are known for their rapid growth and ability to reach market weight in a relatively short period (Karnuah and Sebastian, 2010). They have a high feed conversion ratio, meaning they efficiently convert feed into muscle tissue (Shivaprasad, 2000). These chickens have a broad and muscular breast, large legs, and relatively short feathers compared to other chicken breeds. haematological responses are good indicators of the physiological status (Khan *et al.*, 1994) and acts as a pathological reflector of the status of exposed animals to toxicant and other conditions (Olafedehan *et al.*, 2010), hence animals with good blood compositions are likely to show good performance (Isaac *et al*, 2013) as well as provide a good nutritional assessment of diets (Egbunike *et al.*, 2009). This study therefore investigated the haematological responses of broiler chicken fed varied levels of cassava peel meal as a replacement for maize. The objective of the study was to evaluate the impact of pelletized cassava peel-based diets on haematological indices of broiler chicken.

MATERIALS AND METHODS

Site of the Study

The experiment was carried out at the poultry unit of the Olusegun Agagu University of science and Technology (OAUSTECH), Okitipupa, Ondo State, Nigeria. It is located on $6^0$27''11.5''N $4^0$46'05.0''E.

Processing of cassava peels for inclusion in composite broiler diets

Cassava peels were collected from cassava processing farms around Okitipupa local government area, Okitipupa, Ondo state between the month of December and January. The peels were sun dried for an average of 4-5 days

depending on the intensity of sunlight and grinded using local hammer mill to fine particles and stored in sealed nylon bags. Other feed ingredients were bought from commercial feed mill in Akure.

Experimental Birds and Management
A total of 90-day-old Broiler chicks of 0.355 ± 0.5kg were used for the experiment. The birds were randomly allocated to three dietary treatments of three replicates per treatment with 10 birds per replicates in deep litter brooder pens. They were raised for a period of 8 weeks. All the vaccinations and medications schedules were observed.

Experimental Diets
A total of three (3) experimental diets were formulated. Diet 1 contained maize as the main energy source, Diet 2 contained 10% cassava peel, Diet 3 contained 20% cassava peel as the main source of energy and were given as T1, T2 and T3 respectively.

Blood sampling and Haematology measurements
Blood sampling was drawn from the brachial wing vein of three birds per treatment, which is located between the bicep and triceps at the underside of the wing using 5ml syringe. Ethylene Diamine Tetra Acetic (EDTA) was used as anticoagulant. Blood profiles were measured to determine the health status of livestock and blood parameters measured were Haemoglobin levels, the number of red blood cells and white blood cells, packed cell volume/haematocrit, white blood cells using techniques of Pampori and Iqbai. A counting chamber was used to count the RBC and WBC. The percentage of haemoglobin was measured by using 0.1N HCL and distilled water that converted the haemoglobin into acid haematin.

Statistical Analysis
Data were subjected to One-way Analysis of Variance (ANOVA) using general linear model (GLM) procedure of SAS 9.13 (2004). Means were separated using Duncan Multiple Range Test at 5% level of significance.

Table 1: Composition of experimental broiler starter diets (in kg)

INGREDIENTS (%)	T1(Control)	T2(10% CPM)	T3(20%CPM)
Maize	46	36	26
Cassava peel	0	10	20
Soybean	21.1	20.1	19
Groundnut cake	15	15	15
Fish meal	2	2	2
Wheat offal	10.95	11.95	11.95
Bone meal	2	2	2
Oyster shell	2	2	3
Salt	0.25	0.25	0.25
Premix	0.25	0.25	0.25
Methionine	0.2	0.2	0.3
Lysine	0.25	0.25	0.25
Total	100	100	100

Diet T1: Control (maize-based); Diets T2 and T3: 10% and 20% replacement of maize with CPM (Cassava peel meal).

RESULTS
The proximate compositions of the experimental diets used are presented in Table 2. The diet has significant effect ($p<0.05$) on all the proximate composition for ASH highest value was observed in T3(20% CPM) (11.84 %) while lowest value was observed in T2 (10% CPM) (9.58 %). T3 has highest value (10.69 %) for moisture; 18.69% for crude fibre while lowest value was observed for fat (7.57%). Highest crude protein value was observed in T1 (20.40%) while the lowest was observed in T3 (15.68%). T2 has highest value of carbohydrate (49.19kcal) while the lowest value was observed in T3. The haematological responses of broiler birds fed diets of cassava peels and maize at various replacement levels are presented in Table 3. There were significant variations ($P < 0.05$) in the responses, for packed cell volume (PCV) highest value was observed in T1 and T3(37.50) while lowest value was observed in T2(36.50). Highest value of Haemoglobin (Hb) was observed in T1(12.35) while lowest value was observed in T2(12.10). T3(9.15) has the highest value for white blood cell (WBC) while lowest value was observed in T2(5.00) among the dietary treatments. The highest Mean corpuscular volume (MCV) value was observed in T3(15.30) while the lowest value was observed in T2(14.05). Highest value for Mean corpuscular Haemoglobin

(MCH) was observed in T3(5.10) while the lowest was observed in T2(4.63). Highest value for Mean corpuscular Haemoglobin concentration (MCHC) was observed in T2(3.40) while the lowest value was observed in T1 and T2 (3.30).

Table 2: Proximate composition of experimental diets fed to broiler chickens

Parameters (%)	T1	T2	T3	SEM	p-value
Ash	10.70^{b} ±0.09	9.58^{c} ±0.02	11.84^{a} ±0.03	0.41	0.0002
Moisture	7.27^{b} ±0.22	7.07^{b} ±0.04	10.69^{a} ±0.18	0.75	0.0009
Ether Extract	8.33^{a} ±0.10	8.65^{a} ±0.14	7.57^{b} ±0.18	0.21	0.026
Crude fibre	6.65^{b} ±0.20	7.93^{b} ±0.01	18.69^{a} ±0.56	2.42	0.0003
Crude Protein	20.40^{a} ±0.11	17.60^{b} ±0.01	15.68^{c} ±0.05	0.86	<0.0001
N.F.E	46.65^{a} ±0.32	49.19^{a} ±0.10	35.55^{b} ±0.93	2.66	0.0009

Means on the same row with different superscripts differed significantly ($p<0.05$). Diet T1: Control (Maize based); Diet T2 and T3; 10% and 20% replacement of maize with CPM; N.F.E (nitrogen free extract).

Table 3: Effect of different levels of cassava peel inclusion on haematological parameters of broiler chicken

Parameters	T_1	T_2	T_3	SEM	p-value
PVC (%)	37.50^{a} ±1.44	36.50^{a} ±0.87	37.50^{a} ±1.44	0.66	0.82
Hb (g/dl)	12.35^{ab} ±0.50	12.10^{b} ±0.29	13.30^{a} ±0.00	0.25	0.09
RBC (x 10^6 /µ/L)	2.60^{a} ±0.00	2.60^{a} ±0.00	2.60^{a} ±0.00	0.00	No sig diff
WBC (x 10^3 /µ/L)	7.00^{b} ±0.58	5.00^{b} ±0.58	9.15^{a} ±0.66	0.67	0.009
MCV (fl)	14.30^{a} ±0.58	14.05^{a} ±0.32	15.30^{a} ±0.00	0.27	0.12
MCH (pg)	4.78^{ab} ±0.19	4.63b ±0.10	5.10^{a} ±0.00	0.10	0.08
MCHC (g/dl)	3.30^{a} ±0.06	3.40^{a} ±0.12	3.30^{a} ±0.00	0.04	0.58

Means on the same row with different superscripts differed significantly ($P<0.05$). Diet T1: Control (Maize based); Diet T2 and T3; 10% and 20% replacement of maize with CPM; SEM: Standard Error of Means; CPM: Cassava Plant Meals Treatment effect).

DISCUSSION

The PVC values in this study ranged from 36.50% to 37.50%, with no significant difference among the groups. This is consistent with previous findings by Esonu *et al*., (2001), who reported that the inclusion of cassava peel meal in broiler diets did not significantly alter PVC values, suggesting that cassava peel does not negatively impact the erythropoietic function of the birds. In contrast, Osei and Duodu (2016) observed a slight decrease in PVC when higher levels of cassava peel were included in the diet, possibly due to reduced nutrient availability leading to slight anemia. The variations in Haemoglobin levels in this study between 12.10 g/dL to 13.30 g/dL. This range was similarly reported by Aro *et al*., (2013) and could be due to the Haemoglobin concentration which did not significantly change with the inclusion of up to 20% cassava peel in the diet. However, some studies, such as that of Teguia *et al*., (2004), noted a slight reduction in Haemoglobin levels when cassava peel was included at higher levels, which they attributed to the presence of cyanogenic glycosides in cassava that might affect iron absorption. The values of RBC reported in this study was in line with the findings of Dada *et al*., (2017), who found RBC counts to not significantly affect the dietary inclusion of cassava peel.

The consistency in RBC values suggests that cassava peel can be included in broiler diets without negatively affecting red blood cell production, confirming Adeyemi *et al*., (2008) who also observed no significant changes in RBC counts. The WBC count showed significant variation, with a decrease in WBC count in the T2 group and an increase in the T3 group. A similar trend was reported by Olukosi *et al*., (2018), where the immune response was modulated by varying levels of cassava peel, leading to changes in WBC counts. High WBC counts could indicate an immune response to potential antinutritional factors in cassava peel, as suggested by Nworgu *et al*., (2007), who observed similar responses in broilers. MCV and MCH values in this study ranged between 14.05 fl to 15.30 fl and 4.63 pg to 5.10 pg, respectively. These values are comparable to those reported by Odukoya *et al*., (2012), who found that cassava peel inclusion did not significantly affect MCV and MCH, suggesting that the erythrocytes' size and Haemoglobin content remained stable. Nkwocha *et al*., (2014) also observed no significant changes in MCV and MCH with up to 20% cassava peel inclusion, further supporting the idea that moderate

inclusion of cassava peel does not impair erythrocyte function. MCHC values remained relatively stable across treatments, ranging from 3.30 g/dL to 3.40 g/dL, which is consistent with findings by Ajayi *et al*., (2007). They reported that the inclusion of cassava peel did not significantly alter the MCHC, indicating that Haemoglobin saturation in red blood cells was unaffected.

CONCLUSION

The haematological responses observed in this study suggest that cassava peel can be included in broiler diets at varying levels (10% and 20% replacement of maize) without significantly affecting haematological parameters. The slight variations in WBC counts and the potential impact on haemoglobin levels at higher inclusion rates should be considered, particularly in relation to the presence of anti-nutritional factors like cyanogenic glycosides in cassava peel.

REFERENCES

Adeyemi, O. A., Jegede, A. V. and Amao, O. A. (2008). Response of broiler chickens to cassava peel meal-based diets supplemented with enzymes. *Livestock Research for Rural Development*, 20(12): 12-17.

Ajayi, F. T., Sunmola, A. O. and Tayo, G. O. (2007). haematological and biochemical indices of weaned rabbits fed diets containing graded levels of fermented cassava peel. *African Journal of Biotechnology*, 6 (19), 2358-2360.

Akinfala, E.O. Aderibigbe, A. O. and Matanmi, O. (2002). Evaluation of the nutritive value of the whole cassava plant as replacement for maize in the starter diets for broiler chicken. *Livestock Research for Rural Development*, 14:56: http://www.lrrd.org/lrrd14/6/akin146.htm.

Akinola, L. A. F and Etuk, M. O. (2015). haematological and serum biochemical responses of broilers fed varying levels of indomie waste-based diets. *Journal of Agriculture and Veterinary Science* (IOSR-JAVS) e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 8 (3): 66-70.

Aro, S. O., Aletor, V. A., Tewe, O. O., and Faniyi, G. F. (2013). Nutritional potentials of cassava root sieviate and peel in broiler production. *Journal of Animal Production Research*, 17(1), 1-12.

Belewu, M.A.A. and Ogunsola, F.O. (2010). haematological and biochemical parameters in west African Dwarf (WAD) bucks feed diets containing Milletiathonningii. *African Journal of Biological Research* 3: 121-124.

Chineke, C.A., Ologun, A.G. and Ikeobi, C.O.N. (2006). haematological Parameters in Rabbit Breeds and Crosses in Humid Tropics. *Pakistan Journal of Biological Sciences*, 9 (11): 2102-2106.

Dada, E. O., Agunbiade, J. A., Adeleye, I. O. A., Fakoya, K. A. and Akinola, S. A. (2017). Performance characteristics and blood profile of broiler chicks fed diets containing graded levels of fermented cassava peel meal. *African Journal of Biotechnology*, 6(19), 2136-2141.

Esonu, B. O., Emenalom, O. O., Udedibie, A. B. I., Herbert, U., Ekpor, C. F., Okolie, I. C., and Ihukwumere, F. C. (2001). Evaluation of the nutritive value of mixture of fermented maize and fermented cassava tuber meals as ingredients in the diet of broiler finisher. *Animal Research International*, 2(1), 91-97.

Okike, I. (2015). High-quality cassava peel mash: A perfect animal feed ingredient in cassava-producing countries. International Institute of Tropical Agriculture (IITA). https://aflasafe.com/wp-content/uploads/publications/99/Okike%20.

Isaac, L. J., Abah, G., Akpan, B., and Ekaette, I. U. (2013). haematological properties of different breeds and sexes of rabbits. *Proceedings of the 18th Annual Conference of Animal Science Association of Nigeria*, 24-27.

Kalio, G. A. and Ingweye, J. N. (2018). Hematologicasl responses of replacement levels of cassava peels and maize as energy sources in broiler diets. *Journal of Agriculture and Veterinary Science,* (IOSR-JAVS) e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 11, Issue 4 Ver. I pp 73-77.

Kana, J.R., Defang, F.H., Mafouo, G.H., Ngouana, R., Moube, N.M., Ninjo, J. and Teguia, A. (2012). Effect of cassava meal supplemented with a combination of palm oil and cocoa husk as alternative energy source on broiler growth. *Archiva Zootechnica*, 15:4:17– 25.

Karnuah, A.B. and Sebastian, C.D. (2010). Growth performance and meat yield of broiler chickens raised under different management systems. *Journal of Poultry Science*, 47(2), 120-127.

Khan, T.A., Zafar, F. and Ali, M. (1994). haematological studies in response to sex and age in Japanese quails (Coturnix coturnix japonica) under semi-arid conditions. *Pakistan Journal of Biological Sciences*, 14(1), 91-95.

Lebot, V. (2009). *Tropical root and tuber crops: cassava, sweet potato, yams and aroids*. Crop Production Science in Horticulture (17), CAB Books, Wallingford, UK: CABI.

Lukuyu, B., Okike, I., Duncan, A., Beveridge, M and Blümmel, M. (2014). Use of cassava in livestock and aquaculture feeding programs. *International Livestock Research Institute (ILRI) Discussion Paper 25*, 84 p.

Moran, E.T. (2007). Breeding, selection, and management for meat production. In E. Moran (Ed.), Poultry Production in Hot climates (pp. 21-43). CABI Publishing.

Nkwocha, L. M., Odoemelam, V. U. and Uzoma, A. O. (2014). Effects of feeding different levels of cassava peel meal on the performance, carcass characteristics, and Haematology of broiler chicks. *Nigerian Journal of Animal Science*, 36(2), 133-140.

Nwokoro, S. O. and Ekhosuehi, E. I. (2005). Effect of replacement of maize with cassava peel in cockerel diets on performance and carcass characteristics. *Tropical Animal Health Production*, 37(6):495–501.

Nworgu, F. C., Adebowale, E. A., and Ogungbade, A. M. (2007). Effects of different dietary levels of cassava peel meal on the performance of finisher broiler chickens. *Journal of Animal and Veterinary Advances*, 6(3), 333-338.

Odukoya, K. E., Adebayo, T. M. and Olaleye, M. T. (2012). Performance of broiler chickens fed cassava peel meal as a replacement for maize in the diet. *Journal of Animal Science Advances*, 2(1), 90-96.

Olafedehan, O. A., Obun, C. O, Yusuf, M. K., Oladefedehan, A. O., Awofolaji, A. O. and Adeniji, A. A. (2010). Effects of residual cyanide in processed cassava peel meals on haematological and biochemical indices of growing rabbits. *Proceedings of 35th Annual Conference of Nigerian Society for Animal Production*, 35, 212-215.

Olukosi, O. A., Ogungbade, A. M. and Idowu, O. M. O. (2018). Effect of cassava peel meal and vitamin C supplementation on growth performance and blood indices of broiler chickens. *Nigerian Journal of Animal Science*, 20(2), 257-263.

Osei, S. A. and Duodu, S. (2016). The effects of feeding cassava peel meal on the growth and carcass characteristics of broiler chickens. *Ghana Journal of Agricultural Science*, 39(2), 115-120.

Raji, M. O., Akinosun, A. A., Abegunde, P. T., Mosobolaje, M. A., Fasasi, M. O. and Bambgose, A. M. (2020). Evaluation of haematological and blood serum indices of broilers starter fed varying levels of sun-dried cassava peels meal as partial replacement for wheat bran. *Nigerian Journal of Animal Production*, 47(3):77 – 82.

SAS Institute Inc. (2004). SAS/STAT software (Version 9.13). SAS Institute Inc.

Shivaprasad, H. L. (2000). Fowl cholera in chickens, turkeys, and other birds. In B.W. Calnek (Ed.), Diseases of Poultry (11th ed., pp. 131-143). lowa state University Press.

Teguia, A., Mbiapo, T., and Beynen, A. C. (2004). Broiler performance upon dietary substitution of maize with cassava peel meal. *International Journal of Poultry Science*, 3(3), 200-204.