Hematological Investigations on Egg-Type Chickens Fed Cassava (*Mannihot esculenta Cranz*) Root Meal Based Layer Diet Supplemented with Farmers Solution Provider: Multiple Dropping (FSPMD) In Nsukka, South-Eastern Nigeria

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Abstract

A 60-week study examined the impact of a dietary egg-enhancing supplement (FSPMD) on the hematological parameters of 300 Gold Neslink chickens in the humid tropical region of Nsukka, eastern Nigeria. The supplement was added to cassava root meal (CRM) at graded levels (0, 25, 50, 75, and 100%) in replacement of maize. Ten experimental diets were formulated, with five fortified with FSPMD and five without. Thirty birds per treatment were randomly assigned to ten dietary treatments (T1-T10), with three replicates in a 5 x 2 factorial arrangement in a Completely Randomized Design. The results showed that the hematological parameters did not differ significantly ($p \geq 0.05$) from conventional reference ranges, indicating that the supplement had no adverse effects on the birds' blood profiles.

***Key Words**: Hematology, Egg-type chicken, Supplementation, CRM, FSPMD*

INTRODUCTION

The protein intake in developing countries is significantly lower than the recommended daily amount, with Nigerians consuming less than 10g of protein per day, of which only 3.2g comes from animal sources (FAO, 2006). This protein deficit is attributed to poverty and the high cost of animal feed (Aderolu, 2003), leading to a decline in animal products in the average Nigerian diet. Poultry farming offers a solution to bridging this protein gap, but the high cost of feed, which accounts for 70-80% of production costs (Omeje et al., 1999; Ijaiya et al., 2004), poses a significant challenge. The limited availability and high demand for cereals in Nigeria further constrain the economic viability of poultry production (Adejumo, 2004). Addressing these challenges is crucial to enhancing protein intake and promoting sustainable poultry production in developing countries.

Pressure from consumers for cheap animal products has necessitated the assessment of local feed ingredients in replacement of the conventional ingredients (Oluokun, 2001). One of the advocated alternatives for replacement of maize in poultry diet is the processed cassava root meal. Cassava (*Manihot esculenta*) is a very popular and abundantly produced tuber crop. It contains 2.66 percent crude protein, 77.13 Nitrogen Free Extract (NFE) and 2680 Kcal kg^{-1} Metabolizable energy (Aduku, 1993). Although it is low in protein, its energy content is high and its price relative to maize is competitive. However, **c**assava alone cannot replace maize in layer diets without adversely affecting the performance (Eruvbetine *et al*., 1994). The low

protein content, essential vitamins and minerals of cassava tubers have been the major factor limiting its use in poultry diets; therefore nutrients' balance in cassava nutrition is inevitable. This can be achieved by incorporating cassava leaves, seeds, or cakes, which are richer in protein, into the diet (Ngika *et al*. 2014) or supplementing the diet with synthetic amino acids, through use of supplements and more than one source of protein. Oruwari *et al*. (2003) stated that with proper protein balance, cassava meal could completely replace maize in poultry diets. Cassava must also be subjected to biofortification of micronutrients, such as vitamin A, iron and Zinc, in areas where mineral and vitamin deficiencies are widespread (Montagnac *et al*. 2009). The use of cassava as an alternative to conventional energy feed stuffs like maize could help to reduce feed costs (Ukachukwu, 2005).

Animal Feed Supplement Manufacturers are not relenting in their efforts to come up with new Products that will help improve performance of laying birds. Recently, a Company called Levjenau Agro & Electrical Company Limited introduced a supplement known as Farmers solution provider: multiple dropping (FSPMD). The Makers claim that the Product, which is completely organic, has the efficacy to promote early ovulation of the hen and makes them start laying eggs as soon as possible and triples the dropping of eggs per hen on daily basis. They also claim that it can increase the size of eggs. There is no literature evidence to support any of these claims.

Even though the emphasis on increase production is the leverage, there should be an eye on the heamatological dispensation of such diets. The analysis of normal haematological parameters of chickens therefore, is very much essential in diagnosing the various pathological and metabolic disorders. It can also be used as a diagnostic tool in order to assess the health status of an individual or flock (Islam *et al*., 2004). Furthermore, Madubuike and Ekenyem (2006) reported that haematological and serum biochemical assay of livestock suggests the physiological disposition of the animals to their nutrition. Haematological changes are routinely used to determine various statuses of the body and to determine stress due to environmental, nutritional and pathological factors (Islam *et al*., 2004). Some components of the blood include erythrocytes, haemoglobin, leukocytes, thrombocytes, blood protein, blood glucose, urea and cholesterol.

This study was thus, designed to investigate the hematological and serum chemistry of egg type chicken fed an egg enhancing bio-fortified cassava root meal.

MATERIALS AND METHODS

The study was conducted at the Department of Animal Science Teaching and Research Farm, University of Nigeria, Nsukka. Nsukka lies in the Derived Savannah region, and is located on Longitude 6º 25´ N and Latitude 7º 24´ E (Ofomata, 1975).

Three hundred (300) 12-week old Gold Neslink pullets were used for the study. The birds were weighed and randomly assigned to the ten dietary treatments at thirty birds each. Each treatment had three replications of ten birds each. At the end of the Pullet Stage, mortalities were recorded; two hundred and forty (240) birds were then selected for the present study. The birds were weighed and randomly assigned to ten (ten) dietary treatments of twenty four (24) birds each. Each treatment had three replications of eight (8) birds each. Feed and water were provided *ad libitum*. Routine vaccination and necessary medication as usual were given to the experimental birds.

The cassava roots were purchased from the local market. The roots were peeled, washed, chopped and sun-dried. The dried chips were grounded in a hammer mill and the resulting meal was used in the experimental diet. An organic egg enhancing supplement –

Farmers solution provider: multiple dropping (FSPMD) was purchased from Nia Agro Investment Nig. Limited located at Onitsha-Owerri Express Way, behind First City Monument Bank, Ihiala, Anambra State. This was used to fortify the cassava based diets. .

The cassava root meal was included in formulated experimental diets at graded levels of 0, 25, 50, 75, and 100% in replacement of maize while the FSPMD was included at the rate of 130g /100Kg feed for the layers as recommended by the manufacturer (Levjenau Agro & Electrical Co., Ltd.). The Company is based in Malaysia.Ten experimental diets were formulated. Five of the experimental diets were fortified with the organic supplement while the other five were not fortified. The diets were formulated to be isonitrogenous (18 % CP) for layers (Table 1). The Proximate composition of experimental diets were as depicted in Table 2**.** The study lasted for fifty two (52) weeks (from 23rd - 74th week). During 21st - 22nd weeks, the birds were gradually being familiarized to the new diet (layer mash).

At the end of the study, a Veterinary Pathologist was invited from the Faculty of Veterinary Medicine, University of Nigeria, Nsukka for haematological investigation, serum biochemistry study and organ histology.

One bird was randomly selected from each replicate making a total of 3 birds per treatment. For the 10 treatments under investigation, blood samples were collected. Each treatment had a separate syringe to avoid contamination of blood samples between treatments, while a separate needle was used each time blood was drawn on any bird as precautionary measure against transmission of infectious agents bird to bird if any.

Blood samples were collected from the wing vein using a 3ml syringe and a 23-guage needle and placed in micro tubes with Ethlene diamine tetra acetic acid (EDTA) as anti-coagulant for determining the haematogical and serum biochemical values (Ritchie *et al.* 1994).

Data obtained were subjected to analysis of variance (ANOVA) in a 5 x 2 factorial in Completely Randomized Design (CRD) as described in Statistix (2003) version 8.0. Means were separated using Duncan New Multiple Range Test (DNMRT) at $P < 0.05$.

Table 1: Percentage composition of the Layer diet containing cassava root meal with or without FSPMD- PHASE 2

	LAYER PHASE									
INGREDIENT	**T1 (0)**	**T2 (25)**	**T3 (50)**	**T4 (75)**	**T5 (100)**	**T6 (0)**	**T7 (25)**	**T8 (50)**	**T9 (75)**	**T10 (100)**
Maize	45	33.75	22.50	11.25	0	45	33.75	22.50	11.25	0
Cassava	0	9.25	18.50	27.75	37	0	9.25	18.50	27.75	37
Soybean meal	13	15	17	19	21	13	15	17	19	21
wheat offal	30	30	30	30	30	30	30	30	30	30
PKC	5	5	5	5	5	5	5	5	5	5
Fish meal	2	2	2	2	2	2	2	2	2	2
Bone meal	4	4	4	4	4	4	4	4	4	4
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
VMP	0.25	0.25	0.25	0.25	0.25	0.12	0.12	0.12	0.12	0.12
FSPMD	0	0	0	0	0	0.13	0.13	0.13	0.13	0.13
TOTAL	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
CP(%)	17.99	18.10	18.21	18.20	18.20	17.99	18.10	18.21	18.21	18.20
CF(%)	5.98	5.86	5.76	5.55	5.55	5.98	5.86	5.76	5.76	5.55
ME(kcal/kg)	2587	2583	2579	2575	2572	2587	2583	2579	2575	2572
Cost of feed per kg (₦)	96.20	91.60	90.61	81.61	88.61	95.30	94.30	93.31	92.31	91.31

The organic bio-fortifier- Farmers Solution Provider: Multiple Dropping, an egg enhancing supplement furnished the following amounts of other ingredients per kilogramme of feed: Vitamin A-125000µ ; Vitamin E-4000µ ; Vitamin B2-50mg ; Vitamin B6-10mg ; Vitamin D-15000µ ; Herba epimedii-20mg ; Motherwort-100g ; Isatis root-50g ; Astragalus mongholicus-50g ; Adenophora stricta-50g ; Medicated leaven-200mg and Desert cistanche-50g.

Table 2:Proximate composition of experimental layer diet with or without FSPMD (Dry matter basis)- PHASE 2

	Treatments									
Parameters (%)	**T_1**	**T_2**	**T_3**	**T_4**	**T_5**	**T_6**	**T_7**	**T_8**	**T_9**	**T_{10}**
CP	18.47	17.88	18.05	18.27	18.04	17.98	18.36	18.52	17.74	17.96
CF	4.45	4.52	5.00	5.54	5.31	4.93	5.20	4.65	5.08	5.56
EE	3.02	2.59	3.19	2.84	3.25	3.15	2.82	2.98	3.07	3.22
Ash	3.87	4.55	4.00	4.32	3.90	4.05	3.73	4.17	3.68	4.20
NFE	70.19	70.46	69.76	69.03	69.50	69.89	69.89	69.68	70.43	69.02

RESULTS AND DISCUSSIONS

Hematological values of the experimental birds at the end of the laying phase are shown in **Table 4**.

PACKED CELL VOLUME (PCV)

Mean values for PCV range from 29.00 ± 0.58 - 32.67 ± 0.33. The highest value of 32.67 ± 0.33 was recorded in T_1, while the lowest value of 29.00 ± 0.58 was recorded in T_4. T_1, T_2 and T_8 showed no treatment variations ($P > 0.05$) but were however, higher than the rest of the other treatments (**Table 4**). The above results fall within the normal PCV range for chickens as reported by Banerjee (2006) who found the normal range of PCV values in chickens to be 24 - 45 %. There were significant ($P < 0.05$) cassava level effects for PCV.

WHITE BLOOD CELLS (WBC) COUNT (/mm^3)

Mean values for WBC range from 8766.67 ± 145.30 - 10233.33 ± 166.67. T_1 - T_5 and T_8 had similar ($P > 0.05$) WBC values. However, T_1 had higher ($P < 0.05$) WBC values than T_7, T_9 and T_{10} which were similar ($P > 0.05$) among themselves. Also, T_2 and T_3 had higher ($P < 0.05$) WBC values than T_9 and T_{10}. T_4 and T_5 were statistically lower ($P < 0.05$) than T_6. There were significant differences ($P < 0.05$) between fortifier treated and non-treated groups. Significant ($P \leq 0.01$) cassava level effects were also observed for WBC.

Generally, the WBC count was lower in treated group (T_7, T_8, T_9 and T_{10}) compared with the non-treated group. It should be borne in mind that the WBC is responsible for the birds' immune system. Even though, the WBC values of treated birds were lower than the controls except in T_6, mortality was not affected. It appears that inclusion of FSPMD did not interfere with the ability of the laying hens to fight infections and did not produce allergic reactions in the birds (Iwuji and Herbert, 2012; Soetan *et al.*, 2013). In all the treatments, WBC values fall within the normal range as reported by Banerjee (2006) and Merck (2006).

RED BLOOD CELLS (RBC) COUNT

Mean values for the RBC range from 3.00 ± 0.00 x 10^6 - 3.67 ± 0.33 x10^6. T_1, T_2 and T_6 had similar ($P > 0.05$) RBC values, which were however higher than the rest of the other treatments. There were significant ($P < .0.01$) cassava level effects. The RBC values observed were within the normal range of 2 - 4 x10^6 earlier reported by Banerjee (2006). The results of the present work have shown that the test ingredient had no significant effect ($P > 0.05$) on the RBC count, which implies that FSPMD is not an immunosuppressant.

MEAN CORPUSCULAR VOLUME, MCV (%)

The mean values for MCV ranges from 8.97 ± 0.39 - 10.25 ± 0.59. The highest value of 10.25 ± 0.59 was recorded in T_3 and T_{10}, while the lowest value of 8.97 ± 0.39 was observed in T_6. All the treatment means of treated and non-treated groups were similar. There were significant ($P < 0.05$) cassava level effects for MCV. The mean corpuscular volume values are useful in the characterization of the erythrocytes, especially in the evaluation of anaemia (Campbell, 1994).

Evidence exists in literature that haematological characteristics of livestock suggest their physiological disposition to the plane of nutrition (Madubuike and Ekenyem 2006). Haematological indices are positively correlated with the nutritional status of the subject. Animals on a high plane of nutrition tend to show better haematological indices than their counterparts on a low plane of nutrition (Ugwu et al. 2008). In the present study, the results observed for the haematological parameters were within normal ranges as reported by Banerjee (2006).

CONCLUSION

The present study shows that the bio-fortification of cassava root meal with an egg enhancing supplement - Farmers solution provider: multiple dropping (FSPMD) has no adverse effect on the blood parameters of Gold Neslink egg type chickens, For higher egg production, it is hereby recommended that poultry farmers may employ the use of Farmers solution provider: multiple dropping (FSPMD) at 100g/100kg feed for pullets and 130g/100kg feed for layers respectively and there should be advocacy for it.

REFERENCES

Abdulrashid, M., Agwuobi L.N, Jokthan G.E. and Abdul, S.B (2007). Carcass quality characteristics of broiler finisher fed taro (*Colocasia esculanta*) cocoyam meal In : *Book of abstract of the 32nd annual conference* , NSAP, held at the university of Calabar, Calabar, Nigeria. Pp. 457 – 460.

Adejumo, D.O. (2004). Performance, organ development and daematology of rats fed sole diets of graded levels of cassava flour and soybean flour (Soygarri) as substitute for energy and protein concentrates. *Tropical Journal of Animal Science,* 7 (1): 57- 63.

Aderolu, A.Z. (2003). Biodegradation of fibrous fed ingredients and their utilization by Broilers and Layers. A Ph.D Thesis Submitted to the Department of Animal Science, University of Ibadan, Nigeria.

Adeyemo I. A., Sani A and Aderibigbe T. A. (2013). Growth Performance and Nutrient Retention of Broiler Chickens Fed *Aspergillus niger* Hydrolysed Cassava Peel Based Diet. *American Journal of Research Communication*, 294-306.

Aduku, A.O. (1993). Tropical Feedstuff Analysis Table. Department of Animal Science, Ahmadu Bello University, Samaru Zaria, Nigeria. Pp: 4.

Akouango P. , Itoua O., Akassa H., and C. Ngokaka (2010) . Étude de la productivité et la conformation d'une bande de poulet de chair soumise à trois types de densité . *Journal of Applied Biosciences,* (64):4832- 4838.

Bamgbose, A.M., Oso, A.O., Omikola, B.G., Agoola, A. and Jegede, A.V. (2007). Performance of finishing Turkeys fed wheat based diets. Proceed. Of 32nd Annual Conference of Nigeria Society of Animal Production,.Pp. 505 – 506.

Banerjee, G.C. (2006). *A Textbook of Animal Husbandry*.8th Ed.Oxford and IBH publishing Co. PVT Ltd, New Delhi, India. P.1068.

Campbell, T.W. (1994). Haematology. In: Ritchie, B.W., Harrison, G.J. and Harrison, L.R. (editors). Avian Medicine: Principles and Application. Wingers Publishers Incorporated, Lake Worth, Florida, USA. Pp. 176-198.

Erubetine, D., Biobaku, W.O. and Onwuka, C.F.I. (1994). Cassava flour as energy for laying hens. *Journal of Agricultural Technol*ogy, (2):76-80.

Food and Agricultural Organisation (2010).
Food and Agricultural Organisation, FAO. Bulletin 8th ed., Rome, 2006.

Fosta and Manjeli, 2010

Ijaiya, A.T., Fasanya, O.O.A. and Ayanwale, B.A. (2004). Reproductive performance of breeding rabbit (does) fed maize and fermented cassava peel meal. Proceedings of the 29th Annual Conference of the Nigeria Society for Animal Production (NSAP).

Iwuji, T.C. and Herbert, U. (2012). Haematological and serum biochemical characteristics of rabbit (bucks) fed diets containing gareimiola kola seed meal. Proceeding of 37th Annual Conference of the Nigeria Society for Animal Prod*uction,* 87-89.

Kargbo, K. and Kanu, S. (2017). Egg quality characteristics of pullet chickens fed Neem (Azdirachta indica) leaf meal (NLM) managed under two housing systems. *Int. J. of Enviroment, Agriculture and Biotechnology (IJEAB)*. 2(4).

Kreman, 2012

Madubuike, F.N and Ekenyem, B.U. (2006). Haematological and serum biochemistry characteristics of broiler chickens fed varying levels of *Ipomoea asarifolia* leaf meal. *International Journal of Poultry Science*, 5(1): 9-12.

Merck Veterinary Manual (2006). Merck, Sharp and Dohme ResearchLaboratories, New Jersey U.S.A.

Montagnac, J.A., Davis, C.R. and Tanumihardjo, S.A. (2009). Nutritional value of cassava for use as a staple food and recent advances for improvement. *Comprehensive Reviews in Food Science and Food Safety*, 8(3):181- 194.

Ngiki, Y.U., Igwebuike, J.U. and Moruppa, S. (2014). Utilization of cassava products for poultry feeding: A review. *International Journal of Science and Tech*nology, (2): 48 - 59.

Nombor, N. T. (2012). Effects of dietary Vitamin C (*L-ascorbic acid*) and Vitamin E (*dl-alphatocopheryl acetate*) on the performance of laying hens in the humid tropics. Ph.D. Thesis. Department of Animal Science, University of Nigeria, Nsukka.

Nwokoro, S.O. and O.O.Tewe (1995). Effects of partial replacement of bone meal with rock phosphate in the diets of laying hens on their performance and egg quality. *Indian Journal Poultry Sci*ence, 30(1): 36-40.

Ofomata, G.E.K. (1975). Soil Erosion. In: Nigerian in Maps. Eastern States. Benin, Ethiope Pub. House. Pp. 43-45.

Oluokun, J.A. (2001). Performance of growing rabbits fed a low protein diet supplemented with urea or roasted soybean meal. *Journal of Poultry Production Research*. (17): 89-99.

Omeje, S.T., Marere, F.U.C.and Isikwnu, J.O. (1999). Comparative effect of usual commercial feeds and cassava based formulation on the performance of Harco and Yaafa cockerels. Proceedings of the 26th Animal conference of the Nigeria Society for Animal Production (NSAP).

Onifade, A.A. and G.M. Babatunde (1997). Comparative utilization of the Tropical by-products feed resources supplemented with or without molasses by broiler chicks. *Archives*, (46): 137-145.

Onyimonyi, A.E., Adeyemi, O. and Okeke, G.C. (2009). Performance and economic characteristics of broilers fed varying dietary levels of neem leaf meal (*Azadirachta indica*). *International Journal of Poultry Sci*ience, 8(3): 256-259.

Oruwari, B.M., Anibo, A.O. and Nkata, D.M. (2003). Effect of replacing maize with cassava / brewers dried yeast blend cassava yeast on performance of broiler chicks and feed cost in Southern Nigeria. *Nigeria Journal Animal Prod*uction, (30):168-174.

Soetan, K.O, Akinrinde, A.S, Ajibade, T.O. (2013). Preliminary studies on the haematological parameters of cockerels fed raw and processed guinea corn (sorghum bicolor). Proceedings of the 38th Annual Conference of Nigerian Society for Animal Production, pp. 49-52.

Statistix (2003). Statistix Analytical Software for windows version 8.0.

Ugwu, S.O.C., Onyimonyi, A.E. and Ozonoh, C.I. (2008). Comparative Performance and Haematological Indices of Finishing Broilers Fed Palm Kernel Cake, Bambara Offal and Rice Husk as Partial Replacement for Maize. *International Journal of Poultry Science*, (7): 299-303.

Ukachukwu, S.N. (2005). Studies on the nutritive value of composite cassava pellets for poultry: chemical composition and metabolizable energy. *Livestock Research for Rural Development*, 17 (11).

White, W.B., H.R. Bird, M.L. Sunde, J.A.A. Marlett, M.A. Prentice and W.C. Burger, (1981). Viscosity of D-glucan as afactor in the enzymatic improvement of barley for chicks. *Poultry Sci*ence, (62): 853-862.