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HAEMATOLOGY AND SERUM BIOCHEMICAL INDICES OF BROILER CHICKENS FED VARYING LEVELS OF INDOMIE WASTE MEAL BASED DIET.

ÍNDICES BIOQUÍMICOS DE HEMATOLOGÍA Y SUERO DE POLLOS DE ASADOR FED VARIOS NIVELES DE DIETA A BASE DE COMIDAS DE RESIDUOS

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ABSTRACT

An eight-week feeding trial was conducted to evaluate the effect of substituting maize with indomie waste meal in a compounded diet for broiler on the haematology and serum biochemical indices of 90 day-old Anak 2000 broiler chickens. Three experimental broiler starter and finisher diets were formulated with diet 1 serving as control containing 0% Indomie waste meal (IWM), while diets 2 and 3 contained IWM at 50 and 100% inclusion levels for maize respectively. The chicks were randomly assigned to the three treatment diets (1, 2 and 3) in a completely randomized design and each treatment group contained three replicates with ten chickens per replicate. The result on the haematological indices revealed that MCV values were significantly influenced ($p<0.05$) by the treatment diets with highest value of (135.50±0.21fl) among birds fed 50% IWM. MCH also significantly varied ($p<0.05$) among birds fed the treatment diets with highest (42.77±0.31pg) recorded among birds maintained on the control diet. Serum biochemical indices revealed that phosphorus value were significantly higher ($p<0.05$) in birds fed the control diet with the mean value of 3.63±0.09mg/100ml. Total cholesterol was significantly higher ($p<0.05$) in birds fed 100% IWM. The overall results from this study conclusively suggest that the inclusion of indomie waste meal in the diet of broilers

up to 100% did not have any detrimental effect on the blood profile of the birds. But precaution had to be taken in the incorporation of IWM at this level because of the increase effect on the cholesterol level of the blood.

Keywords:Broilers, Haematology, Indomie waste, Maize, Serum.

RESUMEN

Se realizó un ensayo de alimentación de ocho semanas para evaluar el efecto de sustituir el maíz con harina de desecho indomie en una dieta compuesta para pollos de engorde en los índices hematológicos y bioquímicos en suero de pollos de engorde Anak 2000 de 90 días de edad. Se formularon tres dietas experimentales de iniciación y finalización de pollos de engorde con la dieta 1 que sirve como control que contiene 0% de harina de residuos Indomie (IWM), mientras que las dietas 2 y 3 contenían IWM a niveles de inclusión de 50 y 100% para el maíz, respectivamente. Los polluelos fueron asignados aleatoriamente a las tres dietas de tratamiento (1, 2 y 3) en un diseño completamente al azar y cada grupo de tratamiento contenía tres réplicas con diez pollos por réplica. El resultado en los índices hematológicos reveló que los valores de MCV fueron influenciados significativamente ($p < 0.05$) por las dietas de tratamiento con el valor más alto de (135.50 ± 0.21fl) entre las aves alimentadas con 50% de IWM. El MCH también varió significativamente ($p < 0.05$) entre las aves alimentadas con las dietas de tratamiento con la más alta (42.77 ± 0.31pg) registrada entre las aves mantenidas con la dieta de control. Los índices bioquímicos en suero revelaron que el valor de fósforo fue significativamente mayor ($p < 0.05$) en las aves alimentadas con la dieta de control con un valor medio de 3.63 ± 0.09mg / 100ml. El colesterol total fue significativamente mayor ($p < 0.05$) en aves alimentadas con 100% de IWM. Los resultados generales de este estudio sugieren de manera concluyente que la inclusión de la comida de desecho indomie en la dieta de los pollos de engorde hasta el 100% no tuvo ningún efecto perjudicial en el perfil sanguíneo de las aves. Pero se tuvo que tomar precaución en la incorporación de IWM a este nivel debido al efecto de aumento en el nivel de colesterol en la sangre.

Palabras clave: pollos de engorde, hematología, residuos de indomie, maíz, suero

INTRODUCTION

One of the major developmental challenges facing most developing countries such as Nigeria is their inability to adequately feed their ever increasing population with the right proportion of animal protein. Maize and soya bean meal which are predominantly used ingredient for energy and protein in poultry feed in Nigeria, is very costly, because of higher demand for it by humans as food and industrial purposes (Bot *et al*., 2013; Etuk*et al*., 2013).These dietary ingredientsconstitute about 50 – 55% of the formulated poultry diet. Besides the high cost of maize as a major component of feed its productivity is low in Nigeria which means it does not meet national demand (Opaluwa*et al.,* 2015). With respect to the

present trend of the rising cost of animal feed stuffs all over the world and the geometric increase in human population, greater attention has to be paid to the search for locally available, safe and cheap feed stuffs including the unexploited ones and agro-industrial by-products especially in the developing countries that cannot afford the expensive diet for livestock. Poultry production especially the production of broiler chickens offers the greatest scope for increasing the quality and quantity of protein intake in Nigeria because of the short generation interval and prolificacy (Ojo, 2003). Poultry production is regarded as a means of sustainable livelihood and a way of achieving a certain level of economic independence (Amos, 2006).Egena and Aya (2007) reported that the replacement of maize with cornflakes waste meal up to 100% level had no adverse effect onthe performance of broiler chickens. The substitution of maize with 50% indomie waste in layers diet significantly reduced cost of production and enhanced performance(Eniolorunda*et al.,*2008).Thus, this study focused on indomie waste, anon-conventional feedstuffs and a fast food for human beings that are highly relished by both children and adults. Indomie noodle is produce from wheat flour, refined palm oil, iodized salt, glutamate, chili powder, onion flavor powder, garlic and flavour spices. During the packaging process of the noodles, the waste obtained is sold to livestock industry as indomie waste, it has several advantages over other non-conventional feed ingredients since indomie noodle is meant for human consumption, they are hygienically packaged and this remove the fear of contamination. Indomie waste has no anti-nutritional factors and the high-energy content of Indomie waste makes it a good substitute for maize and other cereal grains.This study was therefore conducted to examine the haematology and serum biochemical indices of broilers fed varying levels of Indomie waste meal based diets.

MATERIALS AND METHODS

Location and Duration of the Study: The experiment was carried out at the Poultry Unit of the Livestock Section, Teaching and Research Farm, Ambrose Alli University, Ekpoma for a period of eight weeks.

Sources of Ingredients: Indomie noodle waste meal for the study was purchased from Dangote Flour Meal, Illupeju Industrial Avenue, Lagos, Nigeria, while other feed ingredients were purchased in Benin City and Ekpoma, Edo State, Nigeria (Table 1).

Design and Management of Experimental Animal: A total of 90 day-old Anak 2000 broiler chicks were used for the study. Thirty birds each were selected based on their average initial weights and each group of birds was allotted to each of the three treatment diets (1, 2 and 3) in a complete randomized design (CRD). Each treatment group contained 3 replicates of 10 chicks each. All chicks were brooded for four weeks in a deep litter compartment. The house, feeders, and drinkers were properly washed and disinfected. The birds were fed commercial broiler starter diet for one week acclimatization period so as for the birds to get themselves used to the feed before the commensement of the feeding trial. The birds had

access to experimental feeds and clean water *ad-libitum.* Routine medication, vaccination and other management practices were carried out throughout the duration of the experiment.

Table 1. Proximate composition of maize and indomie waste meal

Component	Maize	Indomie waste meal
Dry matter	88.00	88.00
Crude protein	8.90	8.57
Crude fibre	2.70	2.80
Crude fat	4.20	17.14
Crude ash	1.90	0.90
NFE	74.90	58.59
Calcium	0.02	0.05
Phosphorus	0.29	0.32
ME (Kcal/Mg)	3315.45	3799.07

Source : (Lala, 2011) , NFE: Nitrogen free extract

Experimental Diets: A total of three treatment diets (1, 2 and 3) of broiler starter and finisher were formulated. Diet 1 was formulated to contain 42.94% maize (control diet), while 2 and 3 were formulated by replacing the percentage of maize in diet 1 with 50 and 100% levels of indomie waste meal (IWM) respectively. Both starter and finisher diet were iso-nitrogenous (23 and 21%) and iso-caloric (2800 and 3000Kcal/ME/Kg)(Table 2).

Blood Sample Collection and Preparation; Three birds each were randomly selected from each replicate on weight equalization basis and blood samples were collected terminally from each of them through wing vein using syringe and needle. 5ml of blood samples was collected from each bird into a labeled ethylene diamine tetra acetic acid (EDTA) specimen bottles for haematological indices determination. While a second set of 5ml of blood samples were also collected from the same birds into heparinized tubes for serum chemistry determination.

Table 2: Percentage Compositions of broiler Starter and finisher Diets

Ingredients (%)	Inclusion levels of IWM (%)					
	0	50	100	0	50	100
	Starter Diets			Finisher Diets		
	Diet 1	Diet 2	Diet 3	Diet 1	Diet 2	Diet 3
Maize	42.94	21.47	0.00	44.13	22.07	0.00
Indomie Waste Meal	0.00	21.50	42.97	0.00	22.07	44.80
Soya Bean Meal	21.86	21.86	22.20	16.04	16.46	16.46
Groundnut cake	15.00	15.00	15.00	15.00	15.00	15.00
Fish meal	1.00	1.00	1.00	1.77	1.77	1.77
Wheat offal	16.24	16.24	16.24	19.77	19.77	19.77
Oyster shell	2.36	2.36	2.36	2.28	2.28	2.28
Premix	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.01	0.01	0.01	0.01	0.01	0.01
Methionine	0.01	0.01	0.01	0.01	0.01	0.01
Salt	0.30	0.01	0.01	0.01	0.01	0.01
Total	100.00	100.00	100.00	100.00	100.00	100.00
Calculated analysis						
Crude protein	21.00	20.70	20.85	21.00	20.70	20.85
ME (Kcal/Kg)	2800.00	2813.00	2825.00	2800.00	2813.00	2825.00

Determination of haematological and serum biochemical indices: Packed cell volume (PCV), red blood cell (RBC), white blood cell (WBC), haemoglobin (Hb), total protein, albumin, globulin, uric acid, calcium, phosphorus and total cholesterol were determined using methods as described by Dacie and Lewis (1991).The standard ratios of the mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were calculated according to Jain (1986).

Statistical Analysis: Data from the study were subjected to a one way analysis of variance (ANOVA) and significant treatment means were compared using Duncan's multiple range test as outlined by Steel and Torrie (1990) with the aid of SAS (1999) package.

RESULTS AND DISCUSSION

Past reports of Oleredee*t al.* (1996), Sokumbi and Egbunike (2000),Omoikhoje*et al.* (2011) and Igene*et al.*(2012) revealed that blood is very vital to life and before any meaningful study can be done on the biology of birds, detailed haematological study is imperative. This is because any abnormal variation in the haematology of the cell impairs the primary physiological functions of the animal's body.Thehaemotological traits of broiler chickens as influenced by the dietary treatmentsrevealed that Hb,PCV, RBC, WBCand MCHC did not significantly varied ($p>0.05$) among the treatment groups (Table 3). However, MCV and MCH were significantly affected ($p<0.05$) by the treatment diets. MCV was significantly higher ($p<0.05$) in broilers fed on 50% IWM (135.50±0.21 fl), followed by birds fed 0%IWM (128.80±0.23 fl) and least inbirds that consumed 100%IWM (125.83±0.20 fl). MCH was significantly higher ($p<0.05$) in birds fed the control diet (42.77±0.31 pg), followed by birds fed 50%IWM (41.73±0.27 pg) and least in birds fed 100% IWM based diet (40.23 ± 0.25 pg). The significant difference ($p<0.05$) recorded in MCV and MCH levels of broiler chickens fed IWM may be positively correlated with protein quality present in the diet, since haematocrit and haemoglobin are known to be influenced by protein quality and level in a diet (Mitruka and Rawnsley*,* 1977). The increase in the levels of MCV and MCH as the level of IWM increased indicated that the diets were of high quality. The similarities in haemoglobin levels among the birds irrespective of the tested diets may be an indication of the efficiency of the chickens in metabolizing the diets. Haemoglobin is responsible for cellular respiration, which is an important metabolic reaction (Frandson*et al.,* 2009). The values of WBC obtained in this study were within the normal limits for broiler chickens (Olfert*et al*., 1993) which indicated that the birds underwent normal physiological process such as the production of antibodies which is associated with blood characteristics. Esonu*et al.* (2001) reported that haematological constituents are always a reflection of animal's responsiveness to both internal and external environments which include feeds and feeding. The not significant values for PCV, RBC and MCHC despite increasing levels of IWM suggested that the diets were of good quality and free from anti-nutrients. However, all the haemotological values fell within the normal range for chickens (Maxwell *et al.,* 1990).

Table 3: Haematological indices of broiler chickens fed the treatment diets

Parameters	Inclusion levels of IWM (%)		
	0	50	100
	Diet 1	Diet 2	Diet 3
Haemoglobin (g/dl)	10.30 ± 0.37	10.53 ± 0.32	9.40 ± 0.36
PCV (%)	31.63 ± 0.99	32.80 ± 0.92	29.03 ± 0.95
RBC ($x10^6$/dl)	2.47 ± 0.07	2.61 ± 0.06	2.20 ± 0.08
WBC ($x\ 10^3$/dl)	260.13 ± 2.44	271.70 ± 2.43	257.10 ± 2.43
MCV (fl)	128.80 ± 0.23^b	135.50 ± 0.21^a	125.83 ± 0.20^c
MCH (pg)	42.77 ± 0.31^a	41.73 ± 0.27^b	40.23 ± 0.25^c
MCHC (g/dl)	32.50 ± 0.25	32.07 ± 0.24	32.37 ± 0.24

abc: Means in the same row with varying super script differ significantly ($p<0.05$)

The serum chemistry of broiler chickens revealed that significant differences ($p<0.05$) existed in the values of phosphorus and total cholesterol of broilers fed the test diets, but total protein, albumin, globulin, uric acid, calcium and glucose values were not significantly different ($p>0.05$) from one another (Table 4). Broiler chickens maintained on 0% IWM had significantly higher ($p<0.05$) value of phosphorus (3.63±0.09mg/100ml), followed by 3.27±0.08 and 1.97±0.08 mg/100ml in broilers placed on 50 and 100% IWM based diets respectively.Total cholesterol was significantly higher ($p<0.05$) in birds fed 100% IWM (97.33±1.89/100ml), followed by94.00±1.88/100ml in birds fed 50% IWM and 70.67±1.86/100ml in birds fed the control diet. It was obvious from the result that total cholesterol increased progressively as the level of IWM increased. However, birds fed on 50 and 100 % IWM had similar ($p>0.05$) values of cholesterol. The increase in the cholesterol value of diets 2 and 3 may not be unconnected to fat content of IWM. Furthermore, there were no significant variations ($p>0.05$) in the albumin, globulin and glucose values of all the tested diets. Hofferberg and Block (1996) had earlier reported that serum protein and albumin synthesis depend on the availability of protein and as protein intake increases, the rate of synthesis increases where a catabolic rate does not easily change. The uric acid values were not significantly affected ($p<0.05$) which signified that there was no observable muscular wastage due to protein adequacy. This trend was in agreement with the reports of Lamidi*et al.* (2008) and Omoikhoje*et al.* (2011).

Table 4: Serum biochemical indices of broiler chickens fed the treatment diets

Parameters	Inclusion levels of IWM (%)		
	0	50	100
	Diet 1	Diet 2	Diet 3
Total protein (g/100mg)	3.07 ± 0.27	3.70 ± 0.26	3.40 ± 0.26
Albumin (g/100mg)	2.20 ± 0.06	2.23 ± 0.04	2.40 ± 0.08
Globulin (g/100mg)	0.87 ± 0.28	1.53 ± 0.26	1.13 ± 0.27
Uric acid (g/100mg)	2.67 ± 0.51	2.33 ± 0.49	2.53 ± 0.48
Calcium (mg/100ml)	9.83 ± 0.22	9.07 ± 0.23	9.70 ± 0.21
Phosphorous (mg/100ml)	3.36 ± 0.09	3.27 ± 0.08	1.97 ± 0.08
Glucose (mg/100ml)	193.33 ± 15.17	177.00 ± 15.16	194.00 ± 15.19
Total cholesterol (mg/100ml)	70.67 ± 1.86	94.00 ± 1.88	97.33 ± 1.89

abc: means in the same row with varying super script differ significantly ($p<0.05$)

As conclusion, overall results from this study conclusively suggest that the inclusion of indomie waste meal in the diet of broilers up to 50% did not have any detrimental effect on the blood profile of the birds. Precaution in the incorporation of IWM at this level is needful because of the increase effect on the cholesterol level of the blood.

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REFERENCES

Amos, T.T. (2006). Analysis of backyard poultry production in Ondo State, Nigeria. International Journal of Poultry Science, 5(3): 247 – 250.

Olfert, E.D., Cross, B.M. and Mcwilliam, A.A. (1993). *Guide to the Care and Use of Experimental Animals.* Volume 1, Number 2. Canadian Council on Animal Care, Ottawa, Canada.

Bot Mh, Bawa G.S., andAbeke F.O (2013). Replacement value of maize with African locust bean *(Parkiabiglobosa)* pulp meal on performance, haematological and carcass characteristics of broilers. Nigerian Journal of Animal Science, 15: 59-70.

Dacie, J. V. and Lewis, S. N. (1991).Practical Haematology. 8th Edition, Longman Group Limited, London.

EGENA, S.S.A. and Aya, V. E. (2007). Performance and cost implication of feeding broilers with cornflakes waste based diet. Assumption University Journal of Technology, 10(4): 232

Eniolorunda, O.O., Taiwo, B.B.A., Oyewumi, O.O. and Adeyemi, O.A. (2008) Performance of laying hens fed graded levels of Indomie waste as replacement for maize in a humid tropical environment. Research Journal of Animal Science*,* 2: 135 – 138.

Esonu, B.O., Emenalom, O.O., Udebible A.B.I., Herbert, U., Ekpor C.F., Okoli, I.C. and Iheukwumere, F.C. (2001). Performance and blood chemistry of weaner pigs fed raw *Mucuna* (velvet bean) meal. Tropical Journal of Animal Production and Investigation, 4: 49 – 54.

Etuk,E.B., A.V. Ifeduba, U.E. Okata, I. Chiaka, C. Okoli,Ifeanyi,N.J. Okeudo, B.O. Esonu, A.B.I. Udedibie andJ.C. Moreki, (2012). Nutrient Composition and Feeding Value of Sorghum for Livestock and Poultry:a Review. Nigerian Journal of Animal Science. Adf., 2: *510-524.*

Frandson, R.D., Wilke, W.L. and Fails, A.D. (2009). Anatomy and Physiology of Farm Animals. Seventh Edition, Wiley-Blackwell, Ames, Iowa, USA,

Hofferberg, R. and Block, J.F. (1996). Serum metabolites. Journal of Clinical Investigations,45: 143 – 150.

Igene, F., Isika, M., Oboh, S. and Ekundayo, D. (2012). Replacement Value of Boiled Pigeon Pea (*Cajanuscajan*) on growth performance, carcass and haematological responses of broiler chickens. Asian Journal of Poultry Science, *6:*1 – 9.

Jain, N.C., (1986).*Schalm'sVeterinaryHaemotology*. 4th Edition, Lea and Febiger, Philadelphia, USA.

Lala, A. O., Oso, A. O., Fafiolu, A. O., Bamgbose, A. M., Eruvbetine, D. and Bemji, M. (2011). The effects of instant noodles waste in diets for broiler chickens.Nigerian Journal of Animal Production, 38: 97 – 106.

Lamidi, A.W., Fanimo, A.O., Eruvbetine, D. and Biobaku, W.O. (2008). Effect of graded levels of pineapple (*Ananascomosus* L. Meer) crush waste on the performance, carcass yield and blood parameters of broiler chicken. Nigerian Journal of Animal Production, 35: 40 – 47.

Maxwell, M.H., Robertson, G.W., Spence, S. and McCorquodale, C.C. (1990). Comparison of haematological values in restricted-and ad libitum-fed domestic fowls: red blood cell characteristics. British Poultry Science, 31: 407 – 413.

Mitruka, B.M. and Rawnsley, H.M. (1977). *Clinical Biochemical and Hematological Reference Values in Normal Experimental Animals*. Masson Publishing, New York, USA

Olorede, B.R., Onifade, A.A., Okpara, A.O. and Babatunde, G.M. (1996). Growth, nutrient retention, haematology and serum chemistry of broiler chickens fed sheabutter cake or palm kernel-cake in the humid tropics. Journal of Applied Animal Research10:173-166.

Ojo, S.O. (2003)."Productivity and Technical Efficiency of Poultry Egg Production in Nigeria". International Journal of Poultry Sciences 2 (6): 456-464.

Omoikhoje, S.O., Ekoigiawe, I. and Igidi, C.N. (2011). Influence of roasted fluted pumpkin pod husk waste on growth and carcass yield of broiler chickens in humid tropical environment. Indian Journal of Animal Research, 45: 168 – 173.

Opaluwa, H.I., Ali, S.O. and Ukwuteno, S.O. (2015). Perception of the constraints affecting maize production in the agricultural zones of Kogi State, North Central, Nigeria. Asian Journal of Agricultural Extension, Economics and Sociology, 7: 1 – 6.

SAS (1999) *SAS User's Guide: Statistic Released Version 8.0.* Statistical Analysis System Institute Incorporation, NC USA.

Sokumbi, O.A. and Egbunike, G.N. (2000). Physiological responses of growing rabbits to neem *Azadirachtaindica* leaf meal based diets. Haematology and serum biochemistry. Tropical Journal of Animal Production and Investigation, 3: 81 – 87.

Steel R.G.D. and Torrie, J.H. (1990).Principles of Statistics: A Biometric Approach. 2nd Edition, McGraw Hill Book Company Incorporated, New York, USA.

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