

Haematological and Serum Biochemical Responses of Broilers Fed Varying Levels of Indomie Waste-Based Diets

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Abstract: *The haematological and serum biochemical responses of broilers fed indomie waste-based diets (IWBD) were investigated using one hundred and ninety (180) day-old broiler chicks of Anak strain. The chicks were randomly allotted to the different dietary treatments having graded levels of the IWBD in a Completely Randomized Design (CRD). Each treatment contained 3 replicates and each replicate had 12 birds. The treatments, T₁, T₂, T₃, T₄ and T₅ contained IWBD at 0%, 25%, 50%, 75% and 100% respectively as replacement for the maize content in the control diet (T₁). At the end of the eight weeks experimental period, 3 blood sample were collected per replicate (9 samples per treatment) for haematological and serum analysis. Significant differences ($p < 0.05$) were observed in haemoglobin (Hb) and mean corpuscular haemoglobin (MCH) while the values of packed cell volume (PCV), red blood cell (RBC), white blood cell (WBC), platelets, mean cell volume (MCV), mean corpuscular haemoglobin concentration (MCHC), leucocytes, and the heterophil:lymphocyte ratio (H:L) were not significantly different ($p > 0.05$) across the treatments in the haematological parameters examined. The serum biochemical indices did not show any significant differences in all the parameters studied. The values obtained which were within the normal range for healthy birds even where significant differences existed in the haematological values showed that IWBD can be used to replace maize in the diet of broiler chicken up to 100% without any adverse effect on the physiological and health status of the birds.*

Keywords: *Broilers, haematology, indomie waste meal, serum biochemistry.*

I. Introduction

Agro industrial by-products (AIBs) and unconventional feedstuffs (feedstuffs that can be used for livestock feeding but are underused or underexploited by humans) do not present major competition with human food and are thus likely to be available for use at lower cost [1]. The use of unconventional feedstuff in animal feeds had been recommended [1]. Indomie noodles is a popular fast food product well accepted by many households in the tropics, especially Nigeria. The waste produced from the factory during the manufacturing process is usually enormous. It is used by some poultry farmers in view of its high metabolizable energy, ether extract and crude protein contents to replace maize in the diets of broiler chickens both at starter and finisher phases. The major ingredients in indomie instant noodles are wheat and palm oil which makes it to be rich in energy [2]. It is a suitable energy source containing 3464 metabolizable energy (ME) kcal/kg, 94.7% dry matter, 8.75% crude protein (CP), 1.5% crude fibre (CF), 16.35% fat and 13.6% ash [3]. According to [4] reported that broilers in the humid tropical region of Nigeria can tolerate indomie waste in the diets up to 100% level as substitute for maize without adverse effect on the performance and carcass yield. To achieve high productivity and good health, more needs to be known about broilers fed with indomie waste. This is because a good knowledge of the haematological values of animals serves as an index used in predicting the effects of any ration given to animals [5,6]. Reports indicate that the blood variables most consistently affected by dietary influences include RBC, PCV and plasma protein [7,8,9]. In order to confidently use indomie waste meal in broiler production, this study was carried out to examine the haematological and serum biochemical responses of the broilers fed varying levels of IWBD.

II. Materials and Methods

1.1 Experimental Plan

The research work was conducted at the Poultry Unit of the Department of Animal Science, Rivers State University of Science and Technology Teaching and Research Farm, Oroworukwo, Port Harcourt. Indomie noodles waste was obtained from Dufil Prima Food Limited located in Choba, Port Harcourt. The already milled waste (usually milled by the company to avoid illegal re-packaging) was incorporated into broiler starter and finisher diets at 0%, 25%, 50%, 75% and 100% to replace maize which was 43% in the control of the starter diet and 46.70% in the control of the finisher diet (TABLE 1). Diets were isocaloric and isonitrogenous with the starter diets having 2600 Kcal/kg ME and 20.5% CP while the finisher diets had 2900 Kcal/kg ME and 19% CP. A total of one hundred and eighty (180) day old broilers were used for the study which lasted for 8 weeks (56 days). They were assigned randomly to 5 treatments in a completely randomized design (CRD). The

broilers consisted of both sexes. Each treatment consisted of 3 replicates with twelve (12) birds per replicate. Feed and water were provided for the broilers ad libitum throughout the experimental period. All routine vaccination and management practices were duly followed. On arrival of the birds, they were weighed and randomly assigned to the treatments. Birds were fed the starter diet for 4 weeks and the finisher diet for 4 weeks.

Table 1: Composition of experiment starter and finisher diets

Ingredients (%)	T ₁	T ₂	T ₃	T ₄	T ₅	T ₁	T ₂	T ₃	T ₄	T ₅
	(0% IWBD)	(25% IWBD)	(50% IWBD)	(75% IWBD)	(100% IWBD)	(0% IWBD)	(25% IWBD)	(50% IWBD)	(75% IWBD)	(0% IWBD)
		Starter	Diet				Finisher	Diet		
Maize	43.00	32.25	21.50	10.75	0.00	46.70	35.02	23.35	11.68	0.00
IWBD	0.00	10.75	21.50	32.25	43.00	0.00	11.68	23.35	35.02	46.70
PKC	19.00	19.00	19.00	19.00	19.00	10.00	10.00	10.00	10.00	10.00
SBM	20.70	20.70	20.70	20.70	20.70	19.00	19.00	19.00	19.00	19.00
FM	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
WB	9.20	9.20	9.20	9.20	9.20	12.20	12.20	12.20	12.20	12.20
Palm oil	-	-	-	-	-	3.00	3.00	3.00	3.00	3.00
V/TM	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
BM	2.00	2.00	2.00	2.00	2.00	3.00	3.00	3.00	3.00	3.00
D-L Meth.	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Salt	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Lysine	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02

Calculated Nutrient Composition

ME (Kcal/kg)	2645.07	2641.75	2651.32	2653.19	2653.40	2905.94	2922.19	2913.84	2926.21	2928.9
CP	20.55	20.52	20.58	20.51	20.56	19.12	19.02	19.07	19.06	18.99
CF	4.48	4.50	4.52	4.54	4.54	5.12	5.23	5.31	5.37	5.39

IWBD = Indomie waste based diet, PKC = Palm kernel cake, SBM = Soya bean meal, FM = Fish meal, WB = Wheat bran, V/TM – Vitamin and trace mineral premix, BM = Bone meal, ME = Metabolizable energy, CP = Crude protein, CF = Crude fibre.

1.2 Haematology and Serum analysis

At the end of 8 weeks, blood samples (2 ml each) were collected from 3 birds per replicate (9 birds per treatment) by vein puncture of the wings. Blood samples were collected with Ethyl diamine tetra acetic acid (EDTA) bottles for haematological analysis while bottles without EDTA (no anti-coagulant) were used to collect blood samples for serum biochemistry. The haematological parameters studied were haemoglobin (Hb), haematocrit or packed cell volume (PCV), erythrocyte or red blood cell (RBC), leucocyte or white blood cell (WBC), platelets or thrombocytes, mean corpuscular volume (MCV), mean corpuscular haemoglobin concentration (MCHC) and mean corpuscular haemoglobin (MCH), leucocyte differential count (monocyte, lymphocyte, eosinophil, etc) and heterophil (basophil): lymphocyte ratio.

Haematological analysis was done in the laboratory according to the procedure of [10]. From the data generated on the Hb, RBC and PCV, the MCV [(PCV ÷ RBC) X10], MCHC [(Hb ÷ PCV) X100] and MCH [(Hb ÷ RBC) x10] were calculated [11].

Serum biochemical parameters examined included glucose, total protein, albumin, globulin, creatinine, cholesterol, urea, alanine amino transferase (ALT) and aspartate amino transferase (AST).

The total protein was determined by the Biuret method [12] using a commercial kit (Randox Laboratories Ltd, U.K.). The albumin was obtained using the method of [13] while the cholesterol was determined by nonane extraction and enzymatic colorimetric methods using commercial kit (Quimica Clinica Applicada, S.A). The creatinine, urea, and serum enzymes were obtained using the Randox Laboratories Ltd, UK test kits.

All data generated were subjected to statistical analysis of variance procedures of SAS Inc [14]. The treatment means were compared using Duncan's procedures of the same software.

III. Results

The haematological parameters of broilers fed the indomie waste-based diets are shown in TABLE 2. Significant differences ($p < 0.05$) were observed in the Hb and MCH. The PCV, RBC, WBC, platelets, MCV, MCHC, leucocyte differentials and H:L ratio showed no significant differences ($p > 0.05$) across the treatments. The serum biochemistry results did not show any significant difference ($p > 0.05$) in all the parameters studied (TABLE 3).

IV. Discussion

Although there were significant differences in Hb and MCH, the values of Hb obtained were within the normal range for chickens (7-13g/l) as stated by [15]. Haemoglobin values of 6.3-7.8g/l [16] and 8.7-9.3g/l [17] had been reported in indigenous chickens and 8.6-10.7g/l [18] and 11.26-13.1 g/l [19,20] in broilers. The significant value of MCH obtained using [(Hb÷RBC) X10] was within the normal range since the Hb and RBC obtained were within normal range for chicken. This result indicated that the nutrients were adequately utilized by the broilers and posed no problem to the birds. It explains why the birds were healthy, not anaemic and were capable of withstanding stress. The values of PCV, RBC, WBC, platelets, MCV and MCHC obtained in this study which were not significantly different across the treatments and within the normal range for chickens supported the findings of [17]. This showed that the bone marrows of the birds were functioning normally. It revealed the absence of macrocytic and hypochronic anaemia. The normal values of PCV obtained in the study showed that the processing method which gave rise to indomie waste (with wheat as the major component) increased the availability of protein, energy and the degradation of anti-nutritional factors. This according to [21] improves broiler performance. This confirmed that haematological traits, especially PCV and Hb were correlated with the nutritional status of the animal [22] and agreed with [23] who stated that PCV is an index of toxicity in the blood and high levels usually suggest the presence of toxic factors which has adverse effect on blood formation. The normal values of MCV, MCHC and MCH (though significant) obtained in this study indicated that there was no negative interaction between the energy and protein levels in the diets.

The leucocytes differential counts which did not show any significant difference across the treatments indicated that the birds were not stressed during the experiment by nutritional or environmental factors, since leucocyte responses are considered as better indicators of chronic stress [24]. The ratio of the heterophil to lymphocyte (H:L) which was also not significant supported the fact that there was no stress during the study. This confirmed the report by [25] who stated that H:L ratio is a measure of the stress status in poultry. It was also in line with [26] who reported that differences in H:L showed the existence of mild to moderate stress and [27] who stated that H:L ratio was highly heritable. The result therefore showed that heterophenia and basophilia were absent in the birds confirming the result of [28] who stated that extreme stress conditions result in heterophinia and basophilia.

Table 2: Haematological parameters of boilers fed the indomie waste-based diet.

Parameters	T1 (0 % IWBD)	T2 (25 % IWBD)	T3 (50 % IWBD)	T4 (75 % IWBD)	T5 (100% IWBD)	SEM
Hb (g/dl)	10.57 ^a	11.13 ^a	11.13 ^a	7.90 ^b	11.30 ^a	0.23
PCV (%)	31.67	33.00	33.33	25.67	34.00	1.45
RBC (10 ⁶ /ul)	3.13	3.57	2.73	2.13	2.87	0.07
WBC (10 ³ /mm)	21.67	23.00	20.33	20.51	20.13	0.44
Platelet (10 ⁶ /mm ³)	14.21	13.91	14.11	13.92	14.10	0.97
MCV (fl)	101.18	92.44	122.09	120.52	118.47	1.42
MCHC (%)	33.38	33.72	33.39	30.78	33.24	0.48
MCH (pg)	33.77 ^b	31.18 ^b	40.77 ^a	37.09 ^a	39.37 ^a	0.92
Monocytes (%)	2.46	2.38	2.52	2.48	2.71	0.62
Lymphocytes (%)	69.50	63.61	67.51	62.83	61.47	2.01
Eosinophil (%)	2.42	2.53	2.43	2.41	2.44	0.22
Heterophil (%)	3.92	3.90	3.86	3.80	3.81	0.32
H:L Ratio	0.06	0.06	0.06	0.06	0.06	0.001

SEM = Standard Error of Mean, IWBD = Indomie scrap meal, HB = Haemoglobin, PCV = Packed Cell Volume, RBC = Red Blood Cell, WBC = White Blood Cell, MCV = Mean cell volume, MCHC = Mean corpuscular haemoglobin concentration, MCH = Mean corpuscular haemoglobin,

The result of the serum biochemistry parameters which were similar with the control diet implied that IWBD can be used with confidence in broiler diet to provide adequate nutrition. The values of glucose obtained in the various treatments were within the normal range of 9.9-11.1mmol/l stated by [15] when his values of 125-200mg/100ml for glucose were converted to S.I (mmol/l) unit by multiplying by the standard conversion factor of 0.0555. The similarity in serum albumin, creatinine, urea and total protein implied that there was normal protein metabolism. This showed that the diets had better nutritional quality, good amino acid balance, thus there was absence of muscle degeneration of birds. The similarity in the calculated crude fibre in this study may have also contributed to this result, since blood parameters had been reported to be lowered by high inclusion of fibrous ingredients which leads to inferior feed quality [29,30,31]. Also imbalances in amino acid in diets had been found to cause elevated blood urea concentration [32]. The uniformity in the levels of AST and ALT showed that there was no liver damage caused by toxicity of dietary substances. This was in line with the finding of [33] who stated that the values of AST and ALT are normally low in blood but becomes high when there is occurrence of liver damage by toxic substances. The ratio of AST:ALT which were less than one (< 1)

across the treatments confirmed that the internal organs of the chickens were not distorted as [34] stated that AST:ALT ratio of greater than 1 (> 1) compared to a control value of less than 1 implied that the internal organs of the chickens might have been slightly distorted.

Table 3: Serum biochemistry of boilers fed the indomie waste-based diet.

Parameters	T1 (0 % IWBD)	T2 (25 % IWBD)	T3 (50 % IWBD)	T4 (75 % IWBD)	T5 (10 % IWBD)	SEM
Glucose (mmol/l)	8.17	8.17	9.47	9.77	9.47	0.78
Total protein (g/dl)	33.67	32.67	31.00	33.00	32.33	0.34
Albumin (g/dl)	15.33	14.82	14.67	15.33	15.00	0.69
Globulin (g/dl)	18.34	17.85	16.33	17.67	17.33	0.87
Bilirubin (mmol/l)	3.57	3.10	3.73	2.91	3.13	0.43
Creatinine (mmol/l)	1.30 ^b	2.10 ^a	2.97 ^a	1.30 ^b	2.93 ^a	1.03
Calcium (mmol/l)	2.07	2.33	2.13	2.53	1.87	0.44
Cholesterol (mmol/l)	2.77	3.90	3.45	3.77	3.30	0.66
Urea (mmol/l)	3.65	3.81	4.11	4.02	3.99	0.42
ALT (IU/L)	104.79	109.57	113.22	111.28	112.75	2.12
AST (IU/L)	15.65	14.80	13.72	13.81	13.83	0.93
AST:ALT	0.15	0.14	0.12	0.12	0.12	0.04

a,b: means with different superscripts are significantly different (p>0.05)

SEM: Standard Error of Mean.

V. Conclusion

The result obtained in this study showed that indomie waste has high potentials as feed ingredient in broiler diet. The haematological and serum values obtained which were within the normal range even when significant differences existed showed that the diets were adequately utilized indicating the normal functioning of the internal organs and absence of anaemia, stress related diseases and muscle degeneration. Indomie waste can therefore be used to replace up to 100% of the maize content of the control diet since there was no deleterious effect on the birds.

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