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Effects of "Awara" Residue Meal on Heamatology and Biochemical Indices of Broiler Chickens

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Abstract

A feeding trial was conducted at poultry production unit of Gombe State Ministry of Agriculture to investigate the effects of diets containing graded levels of soya bean by-product, popularly known as (awara) residue meal as protein source included at 0, 5, 10, 15, and 20% levels of inclusion on haematology and biochemical indices of broiler chickens. A total of 220 unsexed day old Marshall Broiler chickens were randomly assigned to five dietary treatments each replicated four times in a completely randomised design (CRD). Birds were fed ad libitum daily and the experiment lasted seven weeks. Data collected were haematological parameters such as packed cell volume (PCV), Haemoglobin Concentration (Hb), Red blood cells (RCB), White blood cells (WBC) count and biochemical indices such as serum glucose level, total protein, urea, globulin, albumen etc which were subjected to one way analysis of variance (ANOVA). Results showed no significant difference (P>0.05) with respect to PCV, RBC, and Hb, while significant difference (P<0.05) was obtained in WBC among the treatments. In conclusion, awara residue meal proved to be a good plant protein source for monogastric animals and broiler chicken feeds could contain up to 20% level of its inclusion both during the starter and finisher phases with no adverse effect on haematological and biochemical indices.

***Keywords**: Awara Residue Meals, Soy beans, Broiler chickens, Haematological indices.*

Introduction

System of animal agricultural production put humans and animals in competition for protein and other nutrients. Therefore any positive effort targeted at reducing the cost of feeds will be one of the possible remedy to the shortage of animal protein for human consumption. Residues generated by the food industries represent a potential resource to reduce this problem if properly utilized. The possibility of separation, collection and utilization of food residue as feedstuff for animals has been studied in many places in the world (Farhat *et al*., 2001). The use of local, cheap and readily available material, particularly those that are not directly utilized by man has received particular attention as the only viable alternatives to the use of conventional feed stuffs (Akande *et al*., 2007). Soya bean meal serves as the world standard in regard to protein meals for livestock production (Leeson and Summers, 1997). It is palatable, nutrient dense and highly digestible. Similarly, full fat soya bean (FFSB) was said to possess the same features, but in addition, it is an excellent source of energy and fatty acids. Awara residue (AR) or Okara is a by-product of soymilk or awara processing which contains shells, husk of ground soybean. It is beige in colour and has a light crumbly, fine grained texture which makes it look like moist sawdust or grated coconut and taste similar to almond (Singha *et al*., 2013). Although AR is mostly treated as an industrial wastes with little market value, but it is potentially nutritious product that is high in protein, carbohydrate, vitamins, minerals fibre and fat, Aquado (2010). Ma *et al*. (1997) reported that AR has high quality protein for feeding livestock. Consequently, (Abd-Elsamee *et al.,* 2005) observed that the use of AR as a replacer for soybean meal in broiler diet up to 60% did not adversely affect feed conversion and improve economic efficiency. Finally, The purpose of investigating blood composition is to have a way

of distinguishing normal state from a state of stress (environmental, disease, poor feeding, or management) in an animal (Tewe *et al*., 2006).Haematological and biochemical indices generally provide information on the health status of the animal considered and the effect of feed fed during the period of the study. The use of AR as a protein source for feeding broiler chickens to determine its effects on haematological and biochemical indices of broiler chickens will go a long way in providing accurate information on its adverse effects if any and which may later translate to general public that may consume the poultry products.

Materials and Method

This study was conducted at Gombe State Poultry Production Unit of the State Ministry of Agriculture. Gombe State which lies between latitude 90^0 to 120^0north and longitude 80^0 to 110^0East with an altitude of 407 meters above sea level. It has mean maximum and mean minimum temperature of 32.8^0C and 18.3^0C respectively. The coldest months are from November to January while March to May is the hottest period. Gombe metropolis has a rainfall distribution which ranges from 970.7 mm to 1,142 mm annually, with a mean of 1,009.4 mm. The rain falls from the month of April to October. The vegetation of the area is savannah grassland (Gombe State Government, 2009). Soya bean by-product (Awara residue) was purchased from locals who prepare and sale fried soya bean cake (awara) in Gombe metropolis, Gombe State and Yola, Adamawa State, Nigeria. The residue was boiled for 30 minutes in a large metallic pot and then sun dried to destroy the anti-nutritional factors in it, such as trypsin inhibitors, chymo inhibitors. The processed samples were then analyzed for nutritive value according to AOAC technique (AOAC, 1990). A total of two hundred and twenty (220) unsexed day old Marshall Broiler chicks were used for this experiment. The chicks were obtained at day-old from Sovet International Nig LTD, Kano State Nigeria. Before arrival of the chicks, the room was thoroughly swept, washed with detergent and then disinfected with disinfectant (IZAL). Flat feeding trays were spread on the litter materials (wood shaving) and plastic drinkers for the young chicks in the brooder room. On arrival, chicks were fed commercial broiler starter mash and water containing anti-stress to relieve them of transit stress, charcoal was used to supply warmth to the chicks. The birds were then randomly weigh and allotted to five (5) treatment groups of 44 birds each. Each treatment was replicated four times with 11 birds per replicate in a completely randomized design (CRD). Five starter and five finisher experimental diets were formulated with different graded levels of inclusion of toasted awara residue meal at 0%, 5%, 10%, 15%, and 20% rate. Water and Feeding were provided *ad libitum* throughout the 7 weeks period of the experiment. The gross composition of broiler starter and finisher formulated experimental diets are as shown in (Tables 1 and 2 respectively). At the end of the rearing stage, blood samples were collected from three birds per treatment to determine the haematological and biochemical parameters.

The blood was collected from the jugular vein of the birds into a sample bottle with anticoagulant (EDTA) to determine some haematological indices which include packed cell volume (PCV), Haemoglobin Concentration (Hb), Red blood cells (RCB), White blood cells (WBC) count, Mean corpuscular volume (MCV), Mean corpuscular haemoglobin (MCH), MCHC. Serum from the coagulated blood samples were used to determine some serological parameters which include serum glucose level, total protein, urea, globulin, albumen, high density cholesterol, low density cholesterol, total cholesterol, creatinine, platelets, Neutrophils, Eosinophil, Basophil, monocytes, lymphocyte, Liver Transaminases (ALT), and serum aspartate aminotransferase (AST). Raw and processed awara residue meals as well as test diets were analysed to determine their proximate composition. Metabolizable energy (ME.Kcal/Kg) of awara residue and tested diets were estimated using the method of Pauzenga (1985) as follows: ME = 35 * CP% + 81.8 * EE% + 35.5 * NFE%.

Table 1: Gross Composition of Experimental Starter Diets

Ingredients	T1(0%)	T2(5%)	T3(10%)	T4(15%)	T5(20%)
Maize	46.97	42.63	38.30	43.97	42.97
Soybean	33.63	32.97	27.30	21.63	17.63
Wheat Offal	10.0	10.0	10.0	10.0	10.0
Awara Residue Meal	0.0	5.0	10.0	15.0	20
Fish Meal	5.0	5.0	5.0	5.0	5.0
Bone Meal	2.0	2.0	2.0	2.0	2.0
Limestone	1.50	1.50	1.50	1.50	1.50
Salt	0.25	0.25	0.25	0.25	0.25
Min-vit-Premix*	0.25	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20	0.20
Total	100%	100%	100%	100%	100%
Calculated analysis					
Crude Protein (%)	23	23	23	23	23
Met. energy (Kcal/kg)	2890.61	2891.26	2919.87	2935.89	2950.93
Crude Fibre (%)	4.02	4.99	4.93	5.56	5.91
Ca (%)	1.31	1.31	1.31	1.31	1.31
P (%)	0.68	0.68	0.68	0.68	0.68
Lysine (%)	1.23	1.38	1.30	1.24	1.21
Methionine (%)	1.34	1.34	1.34	1.34	1.34

Table 2: Gross Composition of Experimental Finisher Diets

	Treatment/Diets				
Ingredients	T1 (0%)	T2 (5%)	T3 (10)%	T4 (15%)	T5 (20%)
Maize	50.47	49.47	50.77	47.47	46.47
Soybean	28.13	24.13	19.33	16.13	12.13
Wheat Offal	15.0	15.0	15.0	15.0	15.0
Awara Residue Meal	0.0	5.0	10.0	15.0	20.0
Fish Meal	2.0	2.0	2.0	2.0	2.0
Bone Meal	2.0	2.0	2.0	2.0	2.0
Limestone	1.50	1.50	1.50	1.50	1.50
Salt	0.25	0.25	0.25	0.25	0.25
Min-vit-Premix*	0.25	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20	0.20
Total	100%	100%	100%	100%	100%
Calculated analysis					
Crude Protein (%)	20.0	20.0	20.0	20.0	20.0
Met.energy (Kcal/kg)	2822.07	2837.15	2907.17	2867.31	2882.39
Crude Fibre (%)	4.72	5.05	5.47	5.77	6.11
Ca (%)	1.31	1.31	1.31	1.31	1.31
P (%)	0.68	0.68	0.68	0.68	0.68
Lysine (%)	1.10	1.07	1.02	1.01	0.99
Methionine (%)	1.33	1.34	1.33	1.31	1.34

Key: P = phosphorus, **Ca =** calcium,

Results and Discussion

The results of the proximate analysis of processed awara residue meal obtained in this research is presented in Table 3. It showed that the test diet is highly nutritious and had crude protein content of 30.44%, which is in line with 30.90% crude protein reported by Herman *et al.* 2004, although Surel *et al.* 2005) reported a varied CP of 37.5%, while Vishwanathan (2011) obtained 34.7% CP. This variation may be probably due to difference in varieties and region of production of the soya beans. The crude fibre reported in this research of 11.40% was almost similar to 12.7% reported by Farhat *et al*, (1998). However, higher value of 31.1% crude fibre was reported by Surel *et al*, (2005). Furthermore, the metabolizable energy of 3267.51ME (Kcal/Kg) recorded in this experiment was in agreement with the work of (Herman *et al.,* 2004) who reported 3388 ME (Kcal/Kg). Haematology indices of broiler chicken fed graded levels of awara residue meals (0-7weeks) have been presented in Table 4. The result showed no significant difference ($P>0.05$) with respect to PCV, RBC, and Hb, while significant difference ($P<0.05$) was obtained in WBC. The highest value of WBC was recorded in diet 1 and 2 (234.20, 232.67) while the lowest record was obtained from diets 3, 4, and 5 respectively. There was no variation ($P>0.05$) among the treatment groups with regards to Neutrophils, Monocytes, Lymphocytes, Eosinosphils, MCH, MCV, MCHC, Basophils and Platelets. The haematological parameters showed that only white blood cells (WBC) was significantly different ($P<0.05$) and this was probably due to the mild outbreak of cough in some treatment towards the end of the experiment, and may be the presence of undetected aflatoxin in the feed, since these (WBC) are primarily responsible for defending the body against diseases. Consequently, parked cell volume (PCV), red blood cells (RBC) and haemoglobin were not significantly different ($P>0.05$) among the treatment groups, however the value of haemoglobin concentration obtained in this study falls within the standard normal range of (8.07-8.9g/dl) as outlined by (Mitruka *et al*., 1977). Furthermore, other haematological parameters such as neutrophils, monocytes, lymphocytes, mean corpuscular haemoglobin (MCH), mean corpuscular volume (MCV), and mean corpuscular haemoglobin concentration (MCHC) were not significantly different ($P>0.05$) among the treatment groups, although the values of MCH, MCV, and MCHC obtained from this work are in agreement with the normal range of value for MCV (104-135fl) as reported by (Gylstorff, 1983), while Gullad (1990) reported (32-43.90pg) for the MCH. Furthermore, the non-significant difference ($P>0.05$) observed in the values of haematological components could be related to the nutritional adequacy and safety of the test ingredients, this also indicated that the inclusion level of awara residue meal up to 20% did not adversely affected the health status of broiler chickens. The results of Biochemical indices are presented on Table 5.It showed high significant difference ($P<0.01$) with respect to Albumen, creatinine ($P<0.05$), and low density cholesterol ($P<0.01$) among the treatment groups while no significant difference ($P>0.05$) was observed from total protein, globulin, urea, glucose, high density cholesterol and total cholesterol. Biochemical parameters such as albumen and low density cholesterol were significantly difference ($P<0.001$) and ($P<0.01$) respectively among the treatment groups. The highest level of albumen was recorded in treatment 5 (32.93g/L) while the lowest was in treatment 4 and this is probably due to the sufficient protein content of diet 5 which has the highest inclusion level of awara residue meal. In addition, while creatinine showed significant difference ($P<0.05$) other biochemical parameters such as total protein, urea, total cholesterol, and low density cholesterol were not significantly difference ($P>0.05$) among the treatment groups and this confirms the nutritional adequacy of awara residue meal in meeting the protein needs of the birds. This agreed with the reports of Iyayi and Tewe (1998) who reported that serum, urea and total protein contents depends on both the quality and quantity of protein supplied in the diet.

Table 3: Proximate Compositions of Processed Awara Residue Meal

Nutrients	%
Dry natter	94.67
Crude Protein	30.44
Crude fibre	11.40
Ether extract	8.60
Nitrogen Free extract	40.50
Ash	3.73
Acid detergent fibre	26.33
ME(Kcal/Kg)	3267.51

Key: ME = metabolizable energy, kg = kilo gram

Table 4: Haematological Indices of Broiler Birds Fed Awara Residue Meals

	Diets/Treatments					
Parameters	T1 (0%)	T2 (5%)	T3 (10%)	T4 (15%)	T5 (20%)	SEM
PCV(%)	20.33	22.00	27.67	24.33	22.33	3.99 ^{NS}
RBC ($x10^{12}$/L)	1.46	2.13	2.15	1.42	1.79	0.35 ^{NS}
Hb (mmol/L)	6.90	7.50	9.27	8.20	7.69	1.35 ^{NS}
MCHC (mmol/L)	31.70	30.07	33.27	35.00	31.37	2.24 ^{NS}
WBC($x10^9$/L)	234.20 ^{a}	232.67^{a}	200.33 ^{b}	185.33^{b}	196.80 ^{b}	9.39*
Plateletes ($x10^9$/L)	29.00	39.13	36.23	43.56	27.73	6.85 ^{NS}
Neutrophils (%)	2.33	2.66	2.33	1.33	2.00	0.02 ^{NS}
Monocytes (%)	0.33	0.33	0.33	0.00	0.07	0.00 ^{NS}
Lymphocytes (%)	97.00	97.00	97.33	98.67	97.33	0.072^{NS}
Eosinosphils (%)	0.00	0.00	0.00	0.00	0.00	0.00 ^{NS}
Basophil (%)	0.00	0.00	0.00	0.00	0.00	0.00 ^{NS}
MCH (pg)	39.60	37.17	37.43	39.47	37.69	2.81 ^{NS}
MCV (fl)	125.03	123.83	126.67	127.00	126.33	3.55 ^{NS}

*Abc means on the same row with different superscript are significantly different (P<0.05)**

Key: PCV = packed cell volume, Hb = Haemoglobin Concentration, RCB = Red blood cells, WBC= White blood cells count, MCV = Mean corpuscular volume, MCH = Mean corpuscular haemoglobin.

Table 5: Biochemical Indices of Broiler Birds Fed Awara Residue Meals

	Diets/Treatments					
Parameters	T1 (0%)	T2 (5%)	T3 (10%)	T4 (15%)	T5 (20%)	SEM
Total protein(g/L)	34.33	30.66	33.27	27.07	31.50	3.73 ^{NS}
Albumen(g/L)	15.40^{b}	16.73 ^{b}	16.60^{b}	13.03^{b}	32.93^{a}	2.01*
Globulin(g/L)	13.20	15.13	14.70	14.07	18.07	1.43 ^{NS}
Urea(mmol/L)	3.63	5.03	3.30	5.56	4.47	6.89 ^{NS}
Creatinine(mmol/L)	55.33^{a}	60.00^{a}	51.67^{ab}	74.33^{a}	30.00^{b}	7.23*
Glucose(mmol/L)	10.10	10.67	9.57	10.27	9.73	8.84 ^{NS}
LD Chol(mmol/L)	1.33^{d}	1.43^{c}	1.60^{b}	1.33d	2.20^{b}	1.24*
HD Chol(mmol/L)	2.13	2.03	2.67	2.67	2.77	2.59 ^{NS}
Total Chol(mmol/L)	3.10	3.10	2.80	2.27	4.03	1.22 ^{NS}
ASAT (IU/L)	232.33	241.67	264.33	264.33	228.67	9.51^{NS}
ALAT(IU/L)	15.93	16.00	15.33	11.83	17.33	2.96 ^{NS}

*Abc means on the same row with different superscript are significantly different (P<0.05)**

***Key: SEM=** Standard Error of Means, ASAT = Aspartate transaminase, ALAT = Alanine transaminase, LD=low density cholesterol, HD= High density cholesterol, Chol = cholesterol*

Conclusion and Recommendation

It can be concluded from this research that awara residue meal can be effectively use as broiler chickens feed up to 20% level of inclusion without any adverse effect on haematology and blood biochemical indices of the birds. It is therefore recommended for both poultry farmers and animal feed millers.

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