Haematology and carcass characteristics of broiler chickens fed diets containing rice offal as replacement for wheat offal

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Abstract

The study was conducted at the Teaching and Research farm of the Department of Animal Science Modibbo Adama University Yola. A total of 200, unsexed, day old broiler chicks (ANAK 200) were used for the experiment. The chicks were randomly assigned to five treatments consisting of 40 birds per treatment replicated four times with ten birds per replicate each, in a completely randomized design (CRD). Five (5) starter and finisher diets were formulated for the study, where rice offal replaces wheat offal at 0, 25, 50, 75, and 100% and coded as T1, T2, T3, T4, and T5, respectively. The parameters measured for haematology include PCV, Hb, RBC, MCV, MCH, MCHC and WBCS. While that of carcass characteristics were live weight, Plucked weight, dressed weight, dressing percentage and the weights of cut-up parts which were expressed as percentage of live weight. The result of carcass characteristics showed that there were no significant differences (P> 0.05) among the treatment group. However, the values for live weight ranged from 1580-1852g in treatment 5 and 1, respectively. Plucked weight (g) and dressing percentage (%) ranged from 1381.50- 1725.75, and 63.22- 72.94 in treatment 5 and 1, respectively. values for breast ranges from 15.90- 18.47% and thigh from 11.38- 12.26% in treatment 5 and 1 respectively while drum stick range from 8.16- 10.60% in treatment 4 and 1. The results for organsweihgts showed that there were no significant differences (P> 0.05) among all the treatment groups. Values for gizzard ranged from 2.26 – 3.01% in treatment 1 and 4; intestine from 4.72- 6.15% in treatment 3 and 5; lungs from 0.44 – 0.61% in treatment 1 and 2. Haematological parameters measured included PCV which ranged from 28.44-31.00% , Hb which ranged from 10.00- 10.70g/dl, RBC which ranged from 12.20-13.50 x $10^6 mm^3$, MCV ranged from 22.00-24.35fl, MCH ranged from 7.63-8.45pg, MCHC range from 32.50- 36.12% and WBC ranged from 9.97- 10.30x $10^3 mm^3$ All these haematological values fall within the normal ranges for broiler chickens. It is therefore concluded and recommended that rice offal can completely (100%) replace wheat offal in broiler chickens diet.

Keywords: Carcass Characteristics, Haematology, Broiler Chickens. Rice offal and Wheat offal

Running title: Carcass characteristics of broiler chickens fed rice offal

Hématologie et caractéristiques de la carcasse de poulets de chair nourris avec des régimes contenant des sons de riz en remplacement des sons de blé

Résumé

L'étude a été menée à la ferme d'enseignement et de recherche du Département de Science Animale de l'Université Modibbo Adama à Yola. Un total de 200 poussins de chair d'un jour (ANAK 200), non sexés, ont été utilisés pour l'expérience. Les poussins ont été répartis aléatoirement en cinq traitements comprenant 40 oiseaux par traitement, répétés quatre fois avec dix oiseaux par répétition, selon un dispositif complètement randomisé (DCR). Cinq (5) régimes de démarrage et de finition ont été formulés pour l'étude, où les sons de riz ont remplacé les sons de blé à des taux de 0, 25, 50, 75 et 100 %, codés respectivement comme T1, T2, T3, T4 et T5. Les paramètres hématologiques mesurés comprenaient l'hématocrite (PCV), l'hémoglobine (Hb), les globules rouges (RBC), le volume globulaire moyen (MCV), la teneur corpusculaire moyenne en hémoglobine (MCH), la concentration corpusculaire moyenne en hémoglobine (MCHC) et les globules blancs (WBC). Les caractéristiques de la carcasse évaluées étaient le poids vif, le poids plumé, le poids éviscéré, le rendement en carcasse et les poids des parties découpées, exprimés en pourcentage du poids vif. Les résultats des caractéristiques de la carcasse n'ont montré aucune différence

significative (P > 0,05) entre les groupes de traitement. Cependant, les valeurs du poids vif variaient entre 1580 et 1852 g pour les traitements 5 et 1, respectivement. Le poids plumé (g) et le rendement en carcasse (%) variaient entre 1381,50–1725,75 et 63,22–72,94 pour les traitements 5 et 1, respectivement. Les valeurs pour la poitrine allaient de 15,90 à 18,47 % et celles pour la cuisse de 11,38 à 12,26 % pour les traitements 5 et 1, tandis que le pilon variait de 8,16 à 10,60 % pour les traitements 4 et 1. Les résultats pour les poids des organes n'ont montré aucune différence significative (P > 0,05) entre les groupes de traitement. Les valeurs pour le gésier variaient de 2,26 à 3,01 % pour les traitements 1 et 4 ; celles pour l'intestin de 4,72 à 6,15 % pour les traitements 3 et 5 ; et celles pour les poumons de 0,44 à 0,61 % pour les traitements 1 et 2. Les paramètres hématologiques mesurés comprenaient l'hématocrite (PCV), qui variait de 28,44 à 31,00 % ; l'hémoglobine (Hb), de 10,00 à 10,70 g/dl ; les globules rouges (RBC), de 12,20 à 13,50 × 106/mm³ ; le volume globulaire moyen (MCV), de 22,00 à 24,35 fl ; la teneur corpusculaire moyenne en hémoglobine (MCH), de 7,63 à 8,45 pg ; la concentration corpusculaire moyenne en hémoglobine (MCHC), de 32,50 à 36,12 % ; et les globules blancs (WBC), de 9,97 à 10,30 × 10³/mm³. Toutes ces valeurs hématologiques se situaient dans les plages normales pour les poulets de chair. Il est donc conclu et recommandé que les sons de riz peuvent remplacer complètement (100 %) les sons de blé dans l'alimentation des poulets de chair.

Mots-clés : Caractéristiques de la carcasse, Hématologie, Poulets de chair, Sons de riz, Sons de blé

Introduction

Increasing demand for food in response to increase in population has raised the level of competitiveness between humans and animals for conventional feedstuff. This makes the cost of producing animal so high and their products so exorbitant beyond the reach of common man, thus necessitating the need to find a way of reducing cost of production by replacing expensive feed ingredients with similar but less expensive ones.

The recent increase in rice production and processing in the country has made rice offal one of the agro-industrial by-product that is cheap and available all year round throughout the northern region compared to wheat offal which is expensive and less available especially in Adamawa, Taraba and southern part of Borno State (Yusuf, 2019). Rice offal, a by-product of rice milling, is a source of feed ingredient in animal production. It is reported to have the proximate chemical composition of 92.58% DM, 6.01% CP, 5.27%EE, 26.28% NFE, 40.06%CF, 20.42% ASH and 1251.80 Kcal/kg ME (Dafwang and Shwarmen, 2021). Farrell, 1994 reported that rice bran can be used in chick's diets, and dietary inclusion levels of up to 20% can be tolerated by chicks without depressing performances.

Materials and methods

The study was conducted at the Teaching and Research Farm of the Department of Animal Science Modibbo Adama University Yola. A total of 200, 1-day-old unsexed broiler chicks (ANAK 2000) were used for the experiment. The chicks were randomly assigned to five treatments consisting of 40 birds per treatment replicated four times with ten birds per replicate each, in a completely randomized design (CRD). One week acclimatization period was given during which commercial starter was fed to the birds. In the second week, experimental diets were gradually introduced at the ratio of 25:75 (day 1), 50:50 (day 2),75:25(day 3) and 100% of the commercial to experimental diet. Clean drinking water was provided *ad-libitum* during the conduct of the experiment. All management practices such as routine vaccination, proper sanitation and treatment of sick birds were strictly adhered to. The experimental diets were fed to the birds for seven weeks.

Experimental diets

Five (5) starter and finisher diets were formulated for the study, where rice offal replaces wheat offal at 0, 25, 50, 75, and 100% and coded as T1, T2, T3, T4, and T5 respectively. Rice offal (un parboiled) was obtained from local rice millers in Jimeta. The proximate composition of the rice offal was 91.42% DM, 7.05% CP, 5.38% EE, 26.40% NFE, 37.56% CF, 19.67% Ash and 1244.00Kcal/kg ME. The diets were formulated to meet the nutritional requirements of the birds. The compositions of the experimental diets and calculated analysis are presented in Tables 1 and 2.

Table 1: Composition (%) and calculated analysis of Experimental starter diets (1-4 weeks)

	Diets with levels of replacements				
Ingredients	T1 (0%)	T2 (25%)	T3 (50%)	T4 (75%)	T5 (100%)
Maize	50.00	50.00	50.00	50.00	50.00
Soya bean	13.00	13.00	13.00	13.00	13.00
Wheat offal	8.00	6.00	4.00	2.00	0.00
Rice offal	0.00	2.00	4.00	6.00	8.00
Fish meal	5.00	5.00	5.00	5.00	5.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Limestone	1.00	1.00	1.00	1.00	1.00
Common salt	0.30	0.30	0.30	0.30	0.30
*Premix	0.25	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20	0.20
Methionine	0.30	0.30	0.30	0.30	0.30
Total	**100**	**100**	**100**	**100**	**100**
Calculated Analysis					
CP (%)	22.71	22.50	22.29	22.08	21.87
ME (KCal/kg)	2849.80	2850.60	2851.40	2852.20	2853.00
CF (%)	3.85	3.99	4.14	4.28	4.43
EE (%)	8.78	8.73	8.68	8.63	8.58
Ca (%)	1.29	1.29	1.29	1.28	1.28
P (%)	0.81	0.83	0.86	0.88	0.90
Lysine (%)	1.41	1.41	1.40	1.40	1.40
Methionine (%)	0.63	0.63	0.63	0.62	0.62

** ME= Metabolizable energy* = Premix supplying the following per Kg of feed:Vitamin A = 12,000.00 IU, Vitamin E = 15,000mg, Folic acid = 1000mg, Pantothenic = 1500mg, acid Vitamin B_{12} = 15,000mg, Vitamin B_6 = 2,500mg, Vitamin K = 2,000mg, Choline = 50,000mg Manganese = 10,000mg, Vitamin D_3 = 25,000 IU, Nicotinic acid = 40,000mg, Vitamin B_1 = 2000mg, Vitamin B_2 = 6000mg, Biotin = 6000mg, Vitamin C = 3000mg, Copper = 15000mg, Cobalt = 250mg and selenium = 1000mg.*

Table 2: Composition (%) and calculated analysis of Experimental finisher diets (4-8 weeks)

	Diets with levels of replacements				
Ingredients	T1 (0%RO)	T2 (25% RO)	T3 (50%RO)	T4 (75%RO)	T5 (100%RO)
Maize	54.00	54.00	54.00	54.00	54.00
Soya bean	9.00	9.00	9.00	9.00	9.00
Wheat offal	11.00	8.24	5.50	2.76	0.00
Rice offal	0.00	2.76	5.50	8.24	11.00
Fish meal	2.00	2.00	2.00	2.00	2.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Limestone	1.00	1.00	1.00	1.00	1.00
Common salt	0.30	0.30	0.30	0.30	0.30
*Premix	0.25	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20	0.20
Methionine	0.25	0.25	0.25	0.25	0.25
Total	**100**	**100**	**100**	**100**	**100**
Calculated Analysis					
CP (%)	20.10	19.81	19.52	19.23	18.94
ME (Kcal/kg)	2807.60	2808.70	2809.80	2810.90	2812.00
CF (%)	3.80	4.02	4.24	4.45	4.67
EE (%)	8.85	8.78	8.70	8.63	8.55
Ca (%)	1.19	1.19	1.19	1.19	1.18
P (%)	0.72	0.75	0.78	0.81	0.84
Lysine (%)	1.21	1.20	1.20	1.19	119
Methionine (%)	0.58	0.57	0.57	0.56	0.56

***** *ME= Metabolizable energy* = Premix supplying the following per Kg of feed:Vitamin A = 12,000.00 IU, Vitamin E = 15,000mg, Folic acid = 1000mg, Pantothenic = 1500mg, acid Vitamin B_{12} = 15,000mg, Vitamin B_6 = 2,500mg, Vitamin K = 2,000mg, Choline = 50,000mg Manganese = 10,000mg, Vitamin D_3 = 25,000 IU, Nicotinic acid = 40,000mg, Vitamin B_1 = 2000mg, Vitamin B_2 = 6000mg, Biotin = 6000mg, Vitamin C = 3000mg, Copper = 15000mg, Cobalt = 250mg and selenium = 1000mg.*

Table 3: Proximate Composition of Rice Offal used in the Experiment

Dry matter	Crude protein	Ether extract	Nitrogen FreeExtract	Crude fibre	Ash	Metabolizable energy
91.42%	7.05%	5.38%	26.40%	37.56%	19,67%	1244.00Kcal/kg

Statistical analysis

All data were subjected to analysis of variance (ANOVA) (Steel and Torrie, 1980), and Duncan's Multiple Range Test was used to separate the means (Duncan 1995)

Results and discussion

The proximate composition of the rice offal is shown in table 3. The values are 91.42% DM, 7.05% CP, 5.38% EE, 26.40% NFE, 37.56% CF, 19.67% Ash and 1244.00Kcal/kg ME. These values are similar to those reported by Dafwang and Shwarmen (1995). The result of carcass characteristics in this study is presented in Table 4, live weight ranged from 1580.00- 1852g on diets 5 and 1, and it is consistent with report of Onuh *et al*., (2015) and Akpet and Ebekwe (2018) who stated that both treated and untreated rice offal can be fed to broilers without harmful effect on growth. Dressing percentage ranged from 63.22- 72.94 on diets 5 and 1, the values for breast also followed the same trend as dressing percentage with numerically higher value (18.49%) in the control group and the lowest (15.90%) in T5(100% rice offal), drumstick also followed a similar trend but with numerically lower value on treatment 4 (75% rice offal). These values are higher than those reported by Akpet and Ebekwe (2018) when they fed graded level of rice offal to broiler chickens. All the remaining cut-up parts did not fallow this trend. The results showed that there were no significant differences (P> 0.05) among the treatment groups for all the parameters measured. The values for live weight is also similar to the report of Usman *et al.* (2020) who replaced wheat offal with rice bran in broiler diets. Values for dressing percentage , are also similar to the report in broiler chickens fed rice milling waste based diet by Onabanjo *et al.* (2021) but not in consistent with the report of Maikano (2012) who fed graded level of rice offal to broiler chickens.

The cut-up parts were expressed as percentage of live weight and the

values were similar to those reported by Onabanjo *et al.* (2021) but higher than those reported by Yusuf, (2019) who replaced wheat offal with maize bran in broiler chickens diets.

Table: 4 Carcass characteristics of broiler chickens fed varying levels of rice offal as substitute for wheat bran

Parameters	T1 (0%RO)	T2 (25%RO)	T3 (50%RO)	T4 (75%RO)	T5 (100%RO)	**SEM**
Live weight (g)	1852.50	1627.50	1632.50	1830.00	1580.00	41.189^{NS}
Plucked weight (g)	1725.75	1475.75	1475.75	1633.25	1381.50	42.348^{NS}
Dressed weight (g)	1347.50	1160.00	1105.75	1258.00	1005.50	37.326^{NS}
Dressing percentage (%)	72.94	71.30	67.74	68.79	63.22	1.0443^{NS}
Breast (%)	18.49	18.24	16.29	17.45	15.90	0.537^{NS}
Thigh (%)	12.25	11.94	12.14	11.77	11.38	0.302^{NS}
Drum stick (%)	10.60	9.98	10.05	8.16	9.03	0.318^{NS}
Back (%)	9.50	9.09	10.23	10.30	9.23	0.232^{NS}
Thorax (%)	4.69	4.62	4.86	4.78	4.07	0.188^{NS}
Neck (%)	5.91	5.49	6.26	5.61	6.12	0.169^{NS}
Wings (%)	8.19	7.67	7.06	7.32	6.98	0.175^{NS}
Shanks (%)	3.34	3.84	3.49	3.21	3.30	0.120^{NS}
Head (%)	2.44	2.57	2.55	2.39	2.54	0.049^{NS}

RO = Rice offal

NS = Not significant

The results for organs weight expressed as percentage of live weight are presented in Table 5. Values for Gizzard ranged from 2.26 to 3.01% in treatments 1 and 4; intestine from 4.72- 6.15% in treatments 3 and 5; lungs from 0.44 - 0.61% in treatments 1 and 2; heart from 0.42 – 0.55 in treatments 1 and 4; and liver from 1.92 – 2.72 in treatments 1 and 3. Also, crop ranged from 0.46 – 0.71% in treatments 1and 4 while proventriculus ranged from 0.39 – 0.55% in treatments 2 and 4. There were no significant differences (P> 0.05) among all the treatment groups in therefore mentioned values. All these values were similar to those reported for wheat offal replaced with rice bran in broiler diets by Usman *et al.* (2020) but higher than those fed rice milling waste base diet reported by Onabanjo *et al.*(2021). The values (for organs weight) reported in this experiment agreed with the report of many researchers (Akpet and Ibekwe 2018, Unuh et al., 2015, Maikano 2012) This showed that replacing wheat offal with rice offal has no any detrimental effects on health and nutritional status of broiler chicken.

Table 5: Organs weight of broiler chickens fed varying levels of rice offal as substitute for wheat bran expressed as percentage of live weight

Parameters	T1 (0%RO)	T2 (25%RO)	T3 (50%RO)	T4 (75%RO)	T5 (100%RO)	SEM
Proventiculus (%)	0.50	0.39	0.44	0.55	0.45	0.344^{NS}
Crop	046	0.64	0.67	0.71	0.60	0.031^{NS}
Gizzard	2.26	2.85	3.01	3.01	2.55	0.120^{NS}
Intestine	4.85	5.09	4.72	5.08	6.15	0.132^{NS}
Lungs	0.44	0.61	0.53	0.54	0.58	0.037^{NS}
Heart	0.42	0.53	0.49	0.55	0.52	0.033^{NS}
Liver	1.92	2.09	2.72	2.43	2.69	0.151^{NS}
Abdominal fat	2.00	1.75	2.10	2.27	2.55	0.124^{NS}

RO = rice offal
NS = Not significant

The values for haematological parameters measured in this experiment are presented in Table 6. There were no significant differences (P<0.05) in all parameter measured among the treatment groups. Numerical differences exist among the groups but this did not follow a definite trend therefore cannot be attributed to treatment effect. The values for PCV and Hb ranged from 28.44-31.00% and 10.00-10.70 g/dL in treatments 3 and 1, respectively while RBC ranged from 12.20-13.50 (x 10^6/mm^3) in treatments 4 and 1. All these values were within the normal ranges for broiler chickens with the exception of RBC which was higher than the normal range reported by Mercks Veterinary manual (2012). Values for MCV ranged from 22.00-23.50 *fl* in treatments 3 and 1, MCH from 7.63-8.45 *pg* in treatments 3 and 5, MCHC ranged from 32.5- 36.12% in treatments 4 and 5 while WBC ranged from 9.97- 10.70 (x 10^3/mm^3). The similarities in these hematological values indicated similarities in nutritional values of wheat and rice offal as sources of fibre in broiler chickens diets. The normal PCV in this study is an indication of effective utilization of both diets by the birds while the normal Hb values further proved the nutritional status of the diets. Similarly, the normal values recorded for WBC is an indication of good immunity and revealed the health status of the birds during the experiment.

Table 6: Haematology of broiler chickens fed varying levels of rice offal as a substitute for wheat bran

Parameters	T1 (0%RO)	T2 (25%RO)	T3 (50%RO)	T4 (75%RO)	T5 (100%RO)	SEM
PCV (%)	31.00	29.66	28.44	30.50	29.75	2.23^{NS}
HB (g/dL))	10.70	10.15	10.00	1020	1063	0.75^{NS}
RBC (x10^6/mm^3)	13.50	12.50	12.45	12.20	12.30	2.23^{NS}
MCV (*fl*)	23.50	2303	22.00	24.35	23.27	1.49^{NS}
MCH (*pg*)	8.00	7.93	7.63	8.00	8.45	0.83^{NS}
MCHC (%)	35.24	34.66	33.50	32.50	36.12	0.42^{NS}
WBC (x10^3/mm^3)	10.30	10.20	9.97	10.50	10.70	11.17^{NS}

Conclusion

Based on the result of this study, the following conclusion was reached:

That rice offal can completely replace wheat offal in broiler chickens diet without compromising carcass yield and blood quality.

It is there recommended that rice offal can be used in place of wheat offal in broiler chickens diet.

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