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Performance, haematological and serum characteristics of broiler chicks fed diets with graded levels of rice offal

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Abstract

The study determined the performance, haematology and serum characteristics of broiler chicks fed graded levels of rice offal diets during an eight (8) week period. One hundred and fifty (150) day-old broiler chicks of Fedan strain were randomly assigned to five treatments of 30 birds each with 10 birds per replicate. The diets were isocaloric and isonitrogeneous. The result obtained showed that there was no significance ($p > 0.05$) different among treatment means in final live weight, body weight gain, weekly live weight, feed cost, and weekly feed conversion ratio (FCR) of both the started and finisher phases. There were also no significant ($p > 0.05$) differences in average weekly feed intake and daily weight gain in the finisher phase, but there were significant ($p<0.05$) differences in daily feed intake and weekly weight gain in the starter and finisher phases of the birds. The haematological values such as white blood cell (WBC), Haemoglobin concentration (Hb), red blood cell (RBC) and lymphocytes were significantly ($p<0.05$) different. All values for blood chemistry fell within normal ranges, indicating that the rice offal inclusion had no harmful effect on the health of the birds. It is concluded that up to 20% of rice offal could be included in broiler diets to reduce cost of feed.

Keywords: haematological, growth, broiler chicks, diets, rice offal

Introduction

The increase level of protein deficiency in most of the developing countries like Nigeria has been attributed to the low consumption of animal products, and these results in the exposure of the citizens to nutritional diseases such as kwashiokor and Marasmus. Animal protein is therefore essential in human nutrition in order to solve the above mentioned problems (Ojewele, 1993; Oladeebo *et al.*, 2007) [23]. Food and Agriculture Organization has recommended about 36g daily of animal protein for an adult of 60Kg (FAO, 2006) [13]. In developed countries like U.S.A, Russia, and China, the consumption of poultry products especially meat and eggs, has consistently increased over the years and this trend is expected to continue.

In developing countries, demand for poultry products will continue to increase. Report has shown that feed supply remains a major constrain in animal production due to the ever-increasing cost of conventional feed ingredients especially the energy and protein feed ingredients like maize, soybean cake and groundnut cake (Ani *et al.*, 2012) [3]. At present, feed accounts for about 75-80% of the cost of poultry production. Also, even when feed is available, Ani and Ogwuowo (2011) have attributed the low protein intake by the average Nigerian to low animal protein production and high cost of animal products and suggested the intensification of the production of highly productive animals with short generational intervals such as poultry, pigs and rabbits (Fielding, 1991; Serres, 1992, Smith, 2001) [15, 28, 31]. More so, the attendant increase in the cost of chicken and eggs indicates that there is every reason to explore the use of alternative and non-conventional ingredients that are cheaper and locally available.

Rice husk is the major part of rice milling waste with about 3.66 kcal/g energy, 5.25% crude protein, and as high as 33% crude fibre (IRRI, 2008) [16]. Oyenuga (1968) [26] reported that husk contains 2.9-3.6% crude protein, 8-12% ether extract, 39-42% crude fibre and 15-22% ash. According to the United State Development Agency (USDA, 2004) crude rice bran contained 12%-13% oil and 4.3% highly unsaponifiable components. The unique combination of lipids (e.g. Oryzanol and tocopherols) and ratio of minerals (e.g. Calcium and Phosphorus) found in rice bran have led companies to produce stabilized rice brans or rice bran oil that are advertised to enhance energy and muscle condition.

The use of rice milling waste as an ingredient in animal feed, especially ruminants and poultry has been well documented. (Dafwang and Shwarmen, 1996; Awesu *et al.*, 2002) [11, 6]. The use of rice husk is detrimental due to its high fibre content. In broilers, high fibre tends to limit the amount of intake of available energy by the birds and it also results in the secretion of excessive nutrients (Kung *et al.*, 2000) [18]. Again, Agbede *et al.*, (2002) [1] had shown that high fibre and lignin contents of rice milling waste are capable of reducing nutrient utilization and also precipitate metabolic dysfunction when ingested by non-ruminants.

There are many agricultural by-products such as rice offal, which is obtained from rice milling waste (RMW). Dafwang and Shwarmen (1996) [11] stated that rice milling waste is the by-product which is gotten from small milling that produce parboiled rice through a mechanism which combines the removal of husk and polishing into one operation to produce the clean grain and rice offal which contains husk, bran, polishing and small quantities of broken grains. Although rice husk does not have nutritive value as it is high in silica and fibre which impede digestibility, the rice bran contains B-Vitamins (Dafwang, 2006) [9].

Rice constitutes the principal food of almost half of the human race and much competition for it by man makes it unavailable as a feed ingredient. Therefore, it is necessary for us to divert our attention to the usage of rice offal which is not consumed by man. The available cereals produced are hardly enough for human consumption not to talk of feeding livestock. Even when these feed ingredients are available, the cost of purchasing them becomes a substantial barrier. Therefore, it becomes necessary to investigate alternative and cheaper sources of feed ingredient as one way of solving the problem. It is hoped that this study will contribute to that endeavour, and although he use of rice offal in the diets of livestock is not new, the actual levels of inclusion of this ingredient in the diets of poultry is yet to be fully established with any certainty. It is hoped that this study will come out with clear statement and recommendation in this regard.

Materials and Methods

Experimental site and Materials

The experiment was conducted at the poultry unit of the Department of Animal Science, Teaching and Research Farm, Faculty of Agriculture and Forestry, Cross River University of Technology, Obubra Campus, Nigeria. The materials that were used in the experiment were: feeders, drinkers, lanterns, kerosene, stoves, wood shavings, wire mesh, sack bags, newspapers, vaccines, drugs, prophylactics, 2x2 planks, anti-stress, weighing balance and birds.

Proximate Analysis of Feed Samples

Five feed samples were collected from five treatment diets and subjected to proximate analysis to determine the under listed fractions as presented in table 2 and 3:

Table 1: Proximate Composition of Experimental Diets

Treatments	C.P%	EE%	C.F%	ASH%	NFE%	Moisture%
T1	26.25	12.50	4.25	3.00	54.00	9.80
T2	24.50	13.50	8.00	3.00	51.00	9.80
T3	19.25	10.50	10.75	5.00	54.00	9.80
T4	20.00	8.00	13.00	5.00	54.00	10.60
T5	26.25	6.50	6.50	6.00	51.00	9.00

Experimental diets

Five boiler starter diets and five finisher diets were formulated (Table 1) with the following ingredients; maize, palm oil, fish meal, vitamin/mineral premix, salt, lysine, methionine, bone meal and full fat soybean. These ingredients were sourced from poultry national services, markets and farm while rice offal was obtained in Ofada rice milling industry in Obubra Local Government Area, Cross River State. Nigeria.

Table 2: Percentage Composition of Broiler Starter Diets

Ingredients	Treatment				
	T1	T2	T3	T4	T5
Maize	45.46	39.92	34.41	28.91	24.69
Full Fat Soybean	48.04	48.58	49.09	49.59	49.81
Rice Offal	0.00	5.00	10.00	15.00	20.00
Fish Meal	1.00	1.00	1.00	1.00	1.00
Bone Meal	3.00	3.00	3.00	3.00	3.00
Common Salt	0.50	0.50	0.50	0.50	0.50
Vit-Min-Premix	0.50	0.50	0.50	0.50	0.50
Methionine	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Palm Oil	1.00	1.00	1.00	1.00	1.00
Total	100.00	100.00	100.00	100.00	100.00

Calculated Composition of Nutrients

Crude Protein %	23.00	23.00	23.00	23.00	23.00
ME/Kcal/kg	3323.43	3217.82	3112.20	3006.59	2935.25
Calcium%	2.43	2.51	2.61	2.70	2.78
Phosphorus%	4.60	4.44	4.54	4.98	5.11
Crude Fibre%	3.76	5.34	6.91	8.49	10.09

Table 3: Percentage Composition of Broiler Finisher Diets

Ingredients	Treatment				
	T1	T2	T3	T4	T5
Maize	55.78	50.26	44.74	39.25	33.75
Full Fat Soybean	37.72	38.24	38.76	39.25	39.77
Rice Offal	0.00	5.00	10.00	15.00	20.00
Fish Meal	1.00	1.00	1.00	1.00	1.00
Bone Meal	3.00	3.00	3.00	3.00	3.00
Common Salt	0.50	0.50	0.50	0.50	0.50
Vit-Min-Premix	0.50	0.50	0.50	0.50	0.50
Methionine	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Palm Oil	1.00	1.00	1.00	1.00	1.00
Total	100.00	100.00	100.00	100.00	100.00

Calculated Composition of Nutrients

Crude Protein %	20.00	20.00	20.00	20.00	20.00
ME/Kcal/kg	3322.60	3216.99	3112.07	3005.77	2900.85
Calcium%	2.19	2.29	2.37	2.46	2.54
Phosphorus%	4.32	4.14	4.54	4.51	4.78
Crude Fibre%	3.53	5.10	6.28	8.25	9.83

There were five (5) treatments in all with different levels of rice offal. That is T1=0%, T2=5%, T3=10%, T4=15% and T5=20% of rice offal inclusion. The diets were formulated to meet the nutrient and energy requirements of broiler starter and finisher phases of production under tropical conditions as recommended by Olomu (1995). The composition of the experimental diets as formulated for starter and finisher phases are shown in table 2 and 3 respectively.

Management of experimental birds

The birds were treated in accordance with the provisions of the report of the ethical committee on the use of animals and humans for biomedical research, University of Nigeria Nsukka, (2006) as reported by Ani *et al.*, (2013) [4]. The birds were selected and randomly assigned to five treatments of thirty (30) birds per treatment with three (3) replicates of ten (10) birds reach. They were raised on deep litter of eight (8) weeks. Appropriate vaccinations and medications were given as at when due and feed were given *ad-libitum*.

Experimental design and Data Collection

The completely randomized design (CRD) was used for this research. Parameters that were measured include; daily and weekly feed intake, weekly live weight, live weight gain, feed conversion ratio, feed cost and mortality. At the eight week, three birds were taken from each treatment for blood chemistry and carcass evaluation.

Blood chemistry

Blood was collected by cutting the jugular vein of three (3) birds per treatment. The blood was collected into properly labelled sterile bottles containing ethylene diamine tetra acid (EDTA) and used to determine haematological parameters of the birds. The haemoglobin concentration was determined spectrophometrically by the cyanmethemoglobin method as described by Ani *et al*., (2012) [3]. Also, Erythrocyte count (RBC) and Leukocyte counts (WBC) were determined using Nebular Haemocytometer after appropriate dilution (Mitruka and Rawnsley, 1977).

The blood samples for the determination of serum characteristics were collected without the addition of EDTA and the following were measured: Potassium Concentration was determined by flame photometry; Albumin, Calcium Concentration, Phosphorus Concentration, Aspartate transaminase (ASP), Alanine transaminase, (ALT), Sodium, Total bilirubin (TB) and total protein were also determined. The analysis was carried out in the medical Biochemistry Laboratory of the University of Calabar.

Method of Statistical analysis

Data obtained were subjected to analysis of variance (ANOVA) and any significant means were separated using the least significant differences (LSD) as outlined by Steel and Torrie, (1980).

Results

The result presented in Table 4 and 5 shows the results of the performance installer and finisher phase. This is an indication that inclusion of up to 20% rice offal in isocaloric broiler starter and finisher diets had no adverse effect on growth. The average weekly weight gain presented in tables 10 and 11 in the finisher phase was also significantly different. The control diet 10%, 15% and 20% inclusion of rice offal were not significantly different from each other and showed better performance that the 5% inclusion level. The average daily weight gains in the finisher phase were not significantly ($p>0.05$) different across the treatments. The results presented on tale 12 on the average weekly FCR in starter and finisher phase showed no significant ($p>0.05$) difference.

However, slight differences occurred between them. In the starter phase, T3 performed better than T4 and were followed by T5 and T1. In finisher phase, T2 also had the best feed to gain ratio followed by T1, T3, T5 and T4 in that order. Results of the carcass characteristics including organ weights are summarized in table 13. The data analysis showed that there were no significant ($p>0.05$) differences in dressed weight, dressing percentage, the weights of the drum stick and thigh, breast and wing, heart and abdominal fat. This shows that the graded levels of rice offal in the diet of broilers had not varied the anatomical and physiological make-up of the birds. There were significant ($p<0.05$) differences in the kidney, gizzard, intestine/crop and liver weights. Kidneys for birds in T5 were significantly ($p<0.05$) heavier; followed by T3, T1, T4 and T2 in the order. T5 was not significantly ($p>0.05$) different from T3 and T1 but significantly different ($p<0.05$) from T2 and T4. Values for T3 and T4 did not differ significantly ($p>0.05$). The pattern of the Kidney weights did not show any definite trend. Differences may be due to biological variability.

The intestinal crop of birds in T1 were higher following by; T5, T4, T3 and T2. The weight of gizzards of birds in T1 was higher, followed by T5, and T4. These differences could be due to the increase in the crude fibre content of the diets. This finding is in agreement with the report of Uzziah and gizzard, kidney, liver and intestinal weights of broilers with increased dietary energy density. The level of rice offal inclusion has no adverse effects ($p>0.05$) table 6 on mean cell haemoglobin count (MCHC) and Neutrophils. From table 7 the data for serum biochemical parameters show that there were no significant ($p>0.05$) observations among the treatment means for sodium, potassium, aspartate transaminase and alanine transaminase and alanine transaminase, and indicate normal physiological values.

Table 4: Result of Performance in the starter phase

Parameters	**T1**	**T2**	**T3**	**T4**	**T5**	**SEM**
Initial weight (g)	**50**	**50**	**50**	**50**	**50**	
Final live weight (g)	1066.67	1105.67	1108.83	916.67	875.39 NS	36.68
Body weight gain (g)	1016.67	1055.67	1058.33	866.67	825.35 NS	36.68
Av. Weekly live weight (g)	531.17	559.75	580.46	495.83	445.14 NS	33.94
Av. Weekly feed intake	49.24^{a}	42.64^{b}	36.43^{c}	54.84^{ab}	61.54^{a}*	4.49
Av. Daily feed intake	7.00^{abc}	6.10^{bc}	5.20^{c}	7.80^{ab}	$8..80^{a}$*	2.09
Av. Weekly weight gain	254.17^{a}	263.88^{a}	264.58^{a}	216.67^{b}	206.35^{b}*	9.17
Av. Daily weight gain	36.31^{a}	37.70^{a}	37.79^{a}	30.95^{b}	29.48^{b}*	1.31
Av. Weekly FCR	0.19	0.16	0.14	0.25	0.29 NS	4.12
Mortality	6	3	3	3	0.00	

*a, b and c means in the same row with similar letters are not significantly ($p>0.05$).

NS= Not significant, SEM= Standards error of mean

Table 5: Summary of performance in the finisher phase

Parameters	T1	T2	T3	T4	T5	SEM
Initial weight (g)	1066.67	1105.67	1108.83	916.67	875.39 NS	36.68
Final live weight (g)	2582.14	2261.00	2361.11	2492.22	2407.14 NS	07.14
Body weight gain (g)	1515.47	1155.33	1252.78	1575.55	1531.75 NS	107.14
Av. Weekly live weight (g)	1938.67	1847.22	1938.68	1911.94	1858.54 NS	57.28
Av. Weekly feed intake	175.13	140.53	176.15	225.67	205.20 NS	21.02
Av. Daily feed intake	26.79^{bc}	20.08^{d}	25.17^{c}	32.24^{a}	29.15^{abc}*	2.09
Av. Weekly weight gain	378.87^{a}	288.83^{b}	313.19^{a}	393.89^{a}	382.94^{a}*	29.83
Av. Daily weight gain	48.31	41.26	44.74	56.27	54.70 NS	5.06
Av. Weekly FCR	0.46	0.48	0.56	0.57	0.53 NS	8.43
Mortality	3.00	0.00	0.00	3.00	0.00	

*a, b and c means in the same row with similar letters are not significantly (p>0.05).
NS= Not significant SEM= Standards error of mean

Table 6: Summary of Carcass Characteristics, weights of Organs and Offals

Parameters	T1	T2	T3	T4	T5	SEM
Dressed weight (g)	1450	1280	1480	1300	1400 NS	2.38
Dressing percentage (%)	56.18	56.87	56.87	52.32	58.32 NS	10.31
Drum stick/thigh (g)	200	200	200	200	200 NS	0.00
Breast and wing (g)	650	575	675	650	650 NS	43.78
Heart	11.67	10.67	10.00	8.00	9.67 NS	8.94
Kidney	2.00^{ab}	$1.17b^{c}$	2.67^{b}	1.67b	3.00^{a}*	1.17
Intestine/crop	175.00^{a}	114.00^{c}	134.00^{bc}	154.00^{a}	160.00^{ab}*	12.72
Gizzard	85.67^{a}	68.00^{bc}	60.67^{c}	74.67^{b}	78.00^{ab}*	2.97
Abdominal fat	38.67	49.67	58.67	37.67	51.00 NS	8.59
Liver	43.00^{a}	39.67^{a}	35.67^{b}	34.67^{b}	40.67^{a}	1.19

*a, b and c means in the same row with similar letters are not significantly (p>0.05).
NS= Not significant, SEM = Standards error of mean

Table 7: Result of haematology parameters

Parameters	T1	T2	T3	T4	T5	SEM
WBCx10^3/µl	11.40^{b}	13.90^{a}	13.70^{a}	15.20^{a}	14.40^{a}*	0.70
RBCx10^3/µl	8.29^{a}	8.98^{a}	6.84^{b}	9.08^{a}	8.15^{a}*	3.46
HGB g/dl	15.40^{a}	14.80^{a}	14.50^{b}	51.10^{cd}	50.57^{ed}*	4.24
MCHC g/dl	32.87	32.87	30.67	32.87	32.13 NS	1.47
LYMx10^3/µl	10.87^{a}	8.85^{c}	9.03^{b}	7.80	9.87^{a}*	4.12
NEUTx10^3/µl	1.87	2.77	2.50	3.20	4.20 NS	5.39

*a, b, c, d means in the same row with similar letters are not significantly (p>0.05) different
NS= Not Significantly, SEM= Standard Error of Mean
Where: WBC= White Bloods, RBC= Red Blood Cells, HGB= Haemoglobin, MCHC= Mean Cell, Haemoglobin Count, LYM= Lymphocyte, NEUT= Neutrophiles

Table 8: Summary of serum biochemistry

Parameters	T1	T2	T3	T4	T5	SEM
Na (mg/dl)	98.91	100.54	102.27	86.42	93.33 NS	16.37
K(mg/dl)	3.71	4.45	4.76	3.66	2.91 NS	1.78
Ca (mg/dl)	33.52^{b}	42.94^{a}	31.16^{b}	40.78a	28.66 ^{b*}	2.02
P (mg/dl)	21.37b	30.72a	32.32a	29.12a	32.32a	1.82
AST (µ/l)	38.15	45.94	53.79	6.13	40.21 NS	3.68
ALT (µ/l)	50.99	50.65	46.25	51.88	51.44 NS	1.49
T.B (mg/dl)	2.95^{a}	3.17^{a}	2.06b	1.97^{b}	3.60*	2.49
T.P (g/dl)	1.97^{bcd}	2.06^{bc}	2.07^{b}	2.76^{a}	1.47^{e}	0.10
ALB (g/l)	1.11^{b}	1.09^{c}	1.07^{d}	1.82^{a}	0.90*	1.15

*a, b, c, d and e: Mean in the same row with similar letters are not statistically (p>0.05) different.
NS= Not Significant, SEM = Standard Error of Mean
Where: - Na = Sodium, K = Potassium, Ca = Calcium, P = Phosphorus, AST = Aspartate Transaminase, ALT = Alanine Transaminase, T.B = Total Bilirubin, T.P = Total Protein, ALB = Albumin.

Discussion

The result presented in table 4 and 5 shows the summary of the performance of the experimental animals at starter and finisher phases respectively. The weekly and daily feed intake of experimental animals in the starter phase were significantly (p<0.05) different. The 15 % and 20% inclusion of rice offal showed significantly (p<0.05) higher level of feed consumption. This observation confirms that of Moran (1977) [20] and Isikwenu *et al.*, *(*2000) [17] who attributed the high feed intake to high dietary fibre level. Kung and Grueling (2000) [18] had reported that high dietary fibre resulted in the limitation of amount of energy available to the birds and correspondingly contributed to excessive nutrient excretion.

In the finisher phase, there were no significant (p>0.05) differences in weekly feed intake. The slight increase observed in the feed intake in T4 and T5 as the level of rice offal increased could be explained with the observation of Banjoko *et al.*, (2008), who reported high feed intake ingredients with lower energy density. The daily feed intake values were significantly (p<0.05) different. This finding confirms Delorme and Wojcik (1982) who reported that excess fibre in the diet of monogastric animals impairs the utilization of other nutrients especially crude protein.

Van der Meulen and Den Dikken (2004) reported that consumption of high fibre diets resulted in significant increase in feed intake. It is possible that the birds fed the diets with the higher rice offal level and thus higher in fibre and unfortunately with lower energy levels, ate more feed to satisfy their energy needs. Birds eat to satisfy their energy needs first. The weekly and daily feed intake of experimental animals in the starter phase were significantly (p<0.05) different. The 15% and 20% inclusion of rice offal showed significantly ($p<0.05$) higher level of feed consumption. This observation confirms that of Moran (1977) [20] and Isikwenu *et al* (2000) [17] who attributed the high feed intake to high dietary fibre level. Kung and Grueling (2000) [18] had reported that high dietary fibre resulted in the limitation of amount of energy available to the birds and correspondingly to excessive nutrient excretion.

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The weekly live weight of the birds at the starter and finisher phases is shown in tables 8 and 9 respectively. From the results, there were no significant ($p>0.05$) differences in the live weights in both starter and finisher phases. This is an indication that inclusion of up to 20% rice offal in isocaloric broiler starter and finisher diets had no adverse effect on growth. This is in agreement with the report of Salami (2009) who showed that inclusion of rice offal up to 20% and 30% in broiler diets had no adverse effects on performance. This result is different from that of Ani *et al.,* (2013) [4] who reported final body weight of broiler chicks fed diets with graded levels of rice milling waste and supplementation of enzyme as follows 0%= 1356.67g, 10=1466.67g, 15%= 1406.67 and 20%= 1370g. Compared with the above results, it is obvious that the birds in this study grew better than those of Ani *et al*., (2013) [4] and co-workers. The complimentary effect of other dietary ingredients in the diet and strain of birds used in this study could be responsible for the observed difference in the live weight of birds.

There were significant differences ($p<0.05$) in weekly and daily weight gains in the brooding phase of the experiment as presented in tables 8 and 9. The control diet, 5% and the 10% inclusion of rice offal showed no difference among themselves and were better than the 15% and 20% levels of inclusion which were equally not significantly ($p>0.05$) different from each other. This finding agrees with earlier studies by Dafwang and Damang (1996) [11, 12] who recommended a limit of 15% in finisher feeds and 10% for broiler starter.

The average weekly weight gain presented in tables 10 and 11 in the finisher phase was also significantly different. The control diet 10%, 15% and 20% inclusion of rice offal were not significantly different from each other and showed better performance that the 5% inclusion level. The average daily weight gains in the finisher phase were not significantly ($p>0.05$) different across the treatments. This was not in agreement with Ani *et al.,* (2013) [4] who reported that average daily weight gain decreased significantly ($p<0.05$) at 20% rice milling waste inclusion with enzyme supplementation. Also, not in agreement with Shakouri and Kermanshashi (2004) [29] who reported that supplementation 20% rice milling waste (RMW) with enzyme improved average daily weight gain. The study had no enzyme supplementation.

The average weekly feed conversion ratio (FCR) in starter and finisher phase showed no significant ($p>0.05$) difference. However, slight differences occurred between them. In the starter phase, T3 performed better than T4 and were followed by T5 and T1. In finisher phase, T2 also had the best feed to gain ratio followed by T1, T3, T5 and T4 in that order. This result is also different from Ani *et al.,* (2013) [4] who reported 0%= 0.94, 10%= 1.01, 15%= 1.15 and 20%= 1.26 with enzyme inclusion. The results showed that there were no significant ($p>0.05$) differences in dressed weight, dressing percentage, the weights of the drum stick and thigh, breast and wing, heart and abdominal fat. This shows that the graded levels of rice offal in the diet of broilers had not varied the anatomical and physiological make-up of the birds. There were significant ($p<0.05$) differences in the kidney, gizzard, intestine/crop and liver weights. Kidneys for birds in T5 were significantly ($p<0.05$) heavier; followed by T3, T1, T4 and T2 in the order. T5 was not significantly ($p>0.05$) different from T3 and T1 but significantly different ($p<0.05$) from T2 and T4. Values for T3 and T4 did not differ significantly ($p>0.05$). The pattern of the Kidney weights did not show any definite trend differences may be due to biological variability.

The intestinal crop of birds in T1 were higher following by; T5, T4, T3 and T2. The weight of gizzards of birds in T1 was higher, followed by T5, and T4. These differences could be due to the increase in the crude fibre content of the diets. This finding is in agreement with the report of Uzzih and Iheagwam (2008) [33] who stated that increase in weight of gizzard, kidney, liver and intestinal weights of broilers increase with dietary energy density. The results shows that there were no significant ($p>0.05$) differences among the treatments in the body weight and body weight gain in both starter and finisher phases. This was not in agreement with SEDI (2013) [27] who reported that rice offal linearly depressed growth performance in birds, Maikano (2005) [19], Salami (2009) [29] and Ani *et al.,* (2012) [3]. Duru and Dafwang (2010) [13] also reported that inclusion of up to 10%-15% rice offal in isocaloric broiler starter and starter diets had no adverse effect on broiler performance. The mortalities recorded were due to rats and an invasion in the pen and not as result of the graded levels of rice offal. Of course, T5 which had the highest level of rice offal inclusion had no mortality. Surprisingly, T1 (control) which was not incorporated with any percentage of rice offal inclusion had no harmful effect on the health of the broiler chicks.

The level of rice offal inclusion has no adverse effects ($p>0.05$) table 6 on mean cell haemoglobin count (MCHC) and Neutrophiles. The result of this study fell within the range of haematological parameter for birds (Blood and Studdert 1999) [8]. The White and Red Blood Cells of T4 were higher than those in other treatments. The major function of the red blood cell is to transport haemoglobin which in turn carries oxygen from the lungs to the tissues (Waugh and Grand, 2010). Low red blood cell lead to tissue necrosis especially the brain, liver, kidney and the heart (Agedeson, 2006) [2]. Whereas, white blood cell has the ability to fight against antibodies (diseases) by the process of phagocytosis.

The inclusion of rice offal at varying levels in the feed had a significant ($p<0.05$) effect on lymphocyte value. It decreases from T1 to T5, T3, T2 and T4 in that order. The significant ($p<0.05$) reduction of lymphocyte and other haematological parameter could predispose the animal to immunological responses (Muhammad and Oloyede, 2009) [22]. The haemoglobin content of birds was higher in T1 and T4. However, values obtained fell within the normal range stipulated for birds according to Blood and Studdert (1999) [8].

The results for serum biochemical parameters (table 7) show that there were no significant ($p>0.05$) observations among the treatment means for sodium, potassium, aspartase transaminase and alanine transaminase and alanine transaminase, and indicate normal physiological values, (Favarato and Zatta 1990; Mitruka and Rawnley 1977) [14, 21]. The calcium content of T2 was significantly ($p<0.05$) higher than that of T4, T1, T3 and T5 which were not significantly ($p>0.05$) different from each other. Phosphorus content of T3 and T5 were the same with values significantly higher ($p<0.05$) than T2 and T4. The significant ($p<0.05$) difference across the treatment means of total bilirubin, total protein and albumin could suggest that rice offal did not aid better protein absorption. Delorme and Wojcik (1982) [12] and shown that excess fibre in the diet of monogastric animals impairs the utilization of other nutrients especially crude protein.

Conclusion

The Performance and blood chemistry of broiler chicks fed with graded levels of rice offal which lasted for 8 weeks showed that chicks can be fed up to 20% rice offal without enzyme supplementation in diets formulated to supply optimum levels of energy and protein without adverse effect on growth performance. This is significant as this will lead to significant savings in the quantity of maize which is in greater need for human food. From this result, it can be recommended that about 20% levels of rice offal can be used in broiler diets. However, further research should be done with higher levels of rice offal inclusion to confirm these findings.

References

1. Agbede JO, Ajaja K, Aletor VA. Influence of Roxazyme G Supplementation on the utilization of sorghum dust-based Diets for broiler chicks. Proc. 25th ann. Conf. Nig. Soc.For Anim. Prod. (NSAP), March fed, fed Univ. Tech Akure, Nigeria. 2002; 14:17-21.
2. Agedeson TJ. The effect of rice offal on blood and internal organs of Broilers chicks; undergraduate project, University of Agric, Makurdi, 2006.
3. Ani AO, Uguwuowo LC, Omeje OD. Growth performance of broiler chicks Fed diets containing raw Bambara nut (Vigna subterranean L) waste and Supplementary enzymes. Afr. J. Biotechno. 2012; 11(56):11991-11997.
4. Ani AO, Kalu I, Uguwuowo LC, Iioh EA. Dietary effect of rice Milling waste and Supplementary enzyme on performance of Broiler chicks Dept. of Anim. Sc., Univ. of Nig, NsukaAfr. Journal Biotechnology. 2013; 12(34):5326-5332.
5. Ani AO, Uguwuowo LC. Response of Weaner rabbits to diets containing Graded levels of processed velvet beans (*Mucuna pruriens*) Afr. J. Biotechno. 2011; 10(66):14984989.
6. Awesu JR, Bamgbose AM, Oduguwa O0, Fanimo AO, Oguntona EB. Performance and nutrient Utilization of cockerel finishers fed graded levels Rice milling waste.Nigerian Journal of Animal production. 2002; 29:81.
7. Banjoko OS, Agunbiade JA, Awojobi AH, Adeyemi OA, Adebayo MO. Nutritional evaluation of layer diets based on cassava products and soybean as influence by protein supplementation and processing. Proc. 33rd Ann. Conf. of NSAP, 18th -20th March. Ayetoro, Ogun State Nig, 2008, 373-376.
8. Blood DC, Studdert VP. Comprehensive Veterinary Dictionary (2nd edition) W.B Saunders, Longer. 1999; 497-499.
9. Dafwang II. Meat, milk and eggs from farm wastes. Explorations in animal Nutrition research and extension. An inaugural lecture. A publication of the University organized lectures committee, vice chancellor’s office, ABU, Zaria, 2006, 73.
10. Dafwang II, Damang P. Rice offal in finishing diets for broiler. Journal Animal production resources. 1996; 16:131-139.
11. Dafwang II, Shwarmen EBN. Utilization of rice offal in practical rations for chicks. Nigerian Journal of Animal production. 1996; 23:21-23.
12. Delorme DB, Wojcik NC. Interaction of dietary protein with cellulose in the adaptation to caloric dilution by weaning rats. J. Nutr. 112:21-28 A.O.A.C, 1990.
13. Duru S, Dafwang II. Effect of maxigrain supplementation of diets with or without rice offal on the performance of broiler chicks, Food and Agricultural Organization. Animal feed resources information system. Production, 88/2 FAO, Rome, Italy, 2006-2010, P12.
14. Favarato M, Zatta P. Chemico-clinicial characterization of rabbit Serum. Journal of Applied rabbit reseach. 1990; 13:14-15.
15. Fielding D. Rabbits. The Tropical Agriculturist. Macmillan Education Ltd. London, 1991, P.106.
16. International Rice Research Institute (IRRI). Rice knowledge Bank International Rice institute Journal. 2008; 50:120-124.
17. Isikwenu JO, Akpodiete OJ, Emegha I, Bratt L. Effect of dietary fibre (maize cob) levels on the growth performance of broiler birds 25th, Annual NSAP conference, Umudike, Abia State, 2000, pp158-160
18. Kung P, Grueling HT. Enzyme supplement of poultry diet containing rice and wheat. Brit. J. Nutr. 2000; 62:139-149.
19. Maikano A. Effect of graded levels of rice offal in broiler diet, MSc 18- Thesis, Animal Science Department, Ahmadu Bello University Zaria, Nigeria, 2005.

20. Moran ET. Performance and nutrient utilization of laying hens fed Practical ration having extremes in fibre contents. Can J. Anim. Sci. 1977; 57:437-438.
21. Mitruka BM, Rawnsley HM. Clinical Biochemistry and haematological reference value in normal experimental animal. Masson, N.Y. Ref. Ed. 1977; 23:506-508.
22. Muhammadu Oloyede NO. Growth performance of broiler chicks fed Aspergillusniger-fermented *Terminalia catappa* seed meal-based diet. Int. J Biochemical Sciences. 2009; 34:62-66.
23. Oladeebo JO, Ambe-Lamidi AI, Jabaru MO. Resource productivity and return to scale in poultry egg production in Afijio Local Government Area, Oyo State. Proc. 32nd Ann conf. Nig. Soc. Anim. Prod; Calabar, 2007, 399-401.
24. Olomu JM. Monogastric Animal Nutrition, principles and practices. A Jachem publication, 1995, 1-5.
25. Ojewole AS. Replacement value of Cashew-nut meal for Soybean meal in finishing broiler chicken. Int. poultry. Sci. 1993; 3(8):513-516.
26. Oyenuga VA. Nigerian feed and feeding stuffs, 3rd Ed. Ibadan University press Ibadan Nigerian, 1968.
27. Salami RI. Un-milling rice offal as a replacement of maize in the enzyme supplement diets of broiler starters: Effect on live performance traits. Proc. Of 14th Ann. Conf. of Ani Sci. Associ. Of Nig (ASAN) Sept, 2009, 14-17, Lagoke University of Technol. Ogbomosho, Oyo State, Nig. Science and Education Development Institute (SEDI, 2013). Performance of broiler finisher chicks fed three types of rice offal based diets. 2009; 3(10):1189-1194.
28. Serres H. Manual of Pig production in the tropics.CAB, International wellington, 1992, 14-50.
29. Shakouri MD, Kermanshashi H. Effect of enzyme supplementation in wheat and trickle based diet on broiler performance. Proceedings of the Annual Conference of the British Society of Animal Science, University of York, York, UK 5-7, 2004, 273.
30. Steel RGD, Torrie JH. Principles and procedures of statistics. A Biometric Approach (2nded.) McGraw-Hill publishers, New York, 1980, 633.
31. Smith AJ. Poultry.The tropical Agriculturalist. Revised ed. MacMillan Education Ltd London, 2001, 1-11.
32. United State Development Agency. Today: Timely topics in nutri. Jrn. Afr. Vet.Med. Assoc. (JAVMA). 2004-2011; 238(5):593.
33. Uzzih II, Iheagwam TC. Response of broiler to graded levels of rice bran diets. Research Project, Imo State Polytechnic, 2008, 85.
34. Van der Meu, Den SJ, Dikken G. Duck keeping in the tropics Macmillan, Netherlands, 2004, 101.