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Response of Broiler Chickens Fed Graded Levels of Goat Rumen Digesta in Replacement for Wheat Offal as Dietary Fibre Source.

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Abstract

The high cost of conventional feedstuffs has necessitated the investigation into unconventional readily available feed alternatives such as Goat Rumen Digesta (GRD). A total of two hundred day old Anak broiler chicks were allocated to five (5) treatments groups (0, 25, 50, 75 and 100% GRC) levels and each treatment were replicated four times. The study was conducted to determine the effect of using different levels of GRD in Broiler Chicks diet on the performance, carcass characteristics, blood chemistry and cost effectiveness. The birds were fed diets containing 23% Crude Protein (CP) and 2900 Kcal/KgME at the starter phase and 20% crude protein and 3000 Kcal/kgME for the finisher phase. The results showed that feed intake, daily weight gain and feed conversion ratio were not significantly different from the control diets at both starter and finisher phases. Carcass analysis showed significant ($P<0.05$) effect of levels of GRD on gizzard. The values ranged from 1.762 to 2.07% on diets 1 and 2 and intestine length values ranged from 163.12 to 212.12cm across the treatments. The result of the blood chemistry analysis showed no significant treatment effect on all the parameters measured, which indicates that GRD does not contain toxic material. Similarly, the feed cost/kg weight gains were cheaper on the GRD diets than on the control diet. The result of this research indicated that GRD can replace wheat offal up to 50% with significant reduction in feed cost.

Key words: Goat Rumen contents, performance, carcass characteristics, blood chemistry, broiler, cost effectiveness.

Introduction

Hassan (2002) reported that in Nigeria, maize has been widely used as the principal energy source in monogastric animal. The author further stated that the keen competition for this ingredient between man, industries and livestock has aggravated the cost of these ingredients, beyond the reach of the average Nigerian livestock farmer. In commercial poultry production feed account for 75 to 80% of total cost of poultry production [1,2]. This high cost of poultry production in Nigeria made it difficult for the poultry farmers to continue in the business, consequently many farmers are quitting commercial poultry production [3]. The feed crises facing poultry industry in Nigeria strongly indicate the need to investigate the possibility of utilizing cheap and easily obtainable non-conventional feed sources, in order to make poultry products affordable to the common man [4,5]. Some of such non-conventional

feed sources are goat rumen content [5,6].

Abubakar and Imam (1995) expressed the view that one of the ways by which developing countries can boost their livestock production is through utilization of slaughter house-by products as livestock feeds. The advantages of their utilization are enormous since these countries will be able to produce more meat and eggs for their teeming population. Moreover, employment generation will be improved while the risk of environmental health hazard in abattoirs will be minimized [7]. Animal feed resources inventory system, [8] reported that no depression in performance was observed when broilers were fed diets in which rumen content replaced all the wheat offal. A strong benefit exists for finding an alternative low cost feed material for poultry feed in order to reduce cost of feed and maximize the returns from poultry farming [9]. Rumen content which is very much available in all abattoirs in Nigeria could be a good sources of protein as well as fibre in livestock feed if properly processed and harnessed [4]. Thus, this study sought to examine the performance, carcass characteristics, blood chemistry and cost effectiveness of broilers fed graded levels of GRD as replacement for wheat offal.

Materials and Methods

Animal feeding and management: A total of two hundred (200) one week old Anak broiler chicks were randomly allocated to five (5) dietary treatments with four (4) replicates of ten (10) chicks each. The birds were fed iso-nitrogenous diets containing 23%Crude Protein (CP) during starter phase and 20% CP during finisher phase. Rumen digesta of certified healthy goats were collected immediately after evisceration at Bauchi abattoir. The rumen digesta were boiled for 2 hours with constant stirring to eliminate pathogens and avoid burning. The GRD were then sundried, milled to powder form and packaged in water prove polyethylene bag. The GRD was incorporated into the starter and finisher diets during the diet formulation at the beginning of each phase at 0, 25, 50, 75 and 100% levels as replacement for wheat offal, designated as diets 1, 2, 3, 4 and 5 respectively. Each diet

	Diets				
Ingredients	**1(0%)**	**2(25%)**	**3(50%)**	**4(75%)**	**5(100%)**
Maize	45.50	45.53	45.50	45.53	45.53
FFSB	35.80	35.77	35.80	35.77	35.80
Wheat offal	10.00	7.50	5.00	2.50	0.00
GRC	0.00	2.50	5.00	7.50	10.00
Fish meal	5.00	5.00	5.00	5.00	5.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Salt	0.25	0.25	0.25	0.25	0.25
Premix*	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Total	**100**	**100**	**100**	**100**	**100**
Calculated Analysis					
ME Kcal/kg	2938	2964	2989	2964	2939
Crude protein	23.00	23.00	23.00	23.00	23.00

Table 1: Percentage composition of broiler starter diets containing graded levels GRD as replacement for wheat offal.

*vit/mineral premix supplied/kg of diet: vitamin A, 12500 I.U, Vit D3, 2,500 I.U, vit E, 30 I.U, Vit K, 2.5mg, Riboflavin, 6mg, pantothenic acid, 10mg, Vit. B1, 2mg, Niacin 30mg, B6,5mg, vit B12, 0.01mg, Biotin, 0.05mg, Folic acid, 1mg, choline chloride, 0.3mg, antioxidant, 0.125mg, iron, 100mg, manganese, 100mg, zinc, 100mg, iodine, 1.5mg, cobalt, 0.5mg, selenium, 0.1mg and copper, 10mg.

	Diets				
Ingredients	**1(0%)**	**2(25%)**	**3(50%)**	**4(75%)**	**5(100%)**
Maize	51.93	51.93	51.93	51.93	51.93
FFSB	28.37	28.37	28.37	28.37	28.37
Wheat offal	13.00	9.75	6.50	3.25	0.00
GRC	0.00	3.25	6.50	9.75	13.00
Fish meal	3.00	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Salt	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Total	**100**	**100**	**100**	**100**	**100**
Calculated Analysis					
ME Kcal/kg	3004	3005	3007	3006	3009
Crude protein	20.00	20.00	20.00	20.00	20.00

Table 2: Percentage Composition of Broiler Finisher Diets containing graded levels GRD as replacement for wheat offal

*Vit/mineral premix supplied/kg of diet: vitamin A, 8,500 I.U, Vit D3, 2,000 I.U, vit E, 10mg, Vit K, 1.5mg, Riboflavin,4mg, pantothenic acid, 5mg B6, 1.5mg, Vit. B1, 1.6mg, Niacin 20mg, vit B12, 0.01mg, Biotin, 0.75mg, Folic acid, 0.5mg, choline chloride, 175mg, antioxidant, 1.25mg, iron, 20mg, manganese, 40mg, zinc, 30mg, iodine, 1mg, cobalt, 0.2mg, selenium, 0.2mg and copper, 3mg

	Diets					
Parameters	**1(0%)**	**2(25%)**	**3(50%)**	**4(75%)**	**5(100%)**	**SEM**
Initial Weight(g)	105.00	110.00	105.00	100.00	105.00	2.31^{NS}
Final Weight(g) (4 weeks)	794.92	845.00	812.36	807.56	787.64	17.50^{NS}
Daily Feed Intake(g)	68.83	70.80	67.66	67.06	67.23	7.29^{NS}
Daily Weight Gain(g)	24.64	26.25	25.27	25.27	24.38	1.83^{NS}
Feed Conversion ratio	2.80	2.71	2.69	2.66	2.78	0.09^{NS}
Mortality (%)	2.50	0.00	2.50	0.00	0.00	-
SEM = Standard Error of Mean						
NS = Not Significant						

Table 3: Performance of Birds fed Graded levels of Goat Rumen Digesta as a Replacement for Wheat Offal at Starter Phase (1-4 weeks).

was then properly mixed using electronic mixer at Abubakar Tafawa Balewa University Feed Mill. The composition of the diets used in the starter and finisher phases are presented in Tables 1 and 2 respectively. The experimental design was a completely randomized design. At the end of the eight weeks feeding trail, two birds per replicate were slaughtered for carcass analysis. The parameters measured were live weight, plucked weight, Eviscerated weight, dressing percentage, gizzard weight, lungs, heart, spleen, kidney, pancreas, and abdominal fat using an electronic balance (ACCULAB), intestine and Caecal

length. Blood samples were collected through the jugular vein during slaughter into sample bottles for haematological (packed cell volume, red blood cells, white blood cells and haemoglobin) and biochemical (total serum protein)analysis.

Data Collection: Data on feed intake, weight gain and mortality were collected and recorded. The prevailing market prices of the ingredients at the time of study were used to calculate the cost per kg feed consumed and the cost of feed/kg weight gain. The data collected were subjected to analysis of variance using MINITAB and the different means were separated using Least Significant Difference (LSD).

Results and Discussions

Starter phase (1-4 weeks)

The daily feed intake, daily weight gain and feed conversion ratio at the starter phase was not significantly different from the control diet. The result was in agreement with reports of Esonu, et al. (2006), who reported that broilers fed 15% dried rumen digesta showed no significant difference in performance between birds fed the treatment diets and those on the control. The result was also similar to those reported by Adeniji and Balogun, (2015) after feeding laying hens with flavour treated blood-rumen content mixture.

Mortality

The mortality of chicks during the starter phase indicated that one chick each was lost from diet 1 and 3 while no mortality was recorded in diets 2, 4 and 5. There was no evidence of any disease regarding the death the chicks.

Finisher phase (5-8 weeks)

The daily feed intake, the daily weight gain and feed conversion ratio were not affected by the dietary

	Diets					
Parameters	**1(0%)**	**2(25%)**	**3(50%)**	**4(75%)**	**5(100%)**	**SEM**
Initial Weight(g)	742.50	735.00	707.50	682.50	682.50	8.23^{NS}
Final Weight(g) (8 weeks)	1835.92	1925.00	1855.84	1761.48	1752.80	17.40^{NS}
Daily Feed Intake(g)	116.79	115.98	120.23	117.41	115.32	1.12^{NS}
Daily Weight Gain(g)	40.95	42.50	41.01	37.64	38.22	0.85^{NS}
Feed Conversion ratio	2.78	2.74	2.94	3.16	3.03	0.12^{NS}
Mortality (%)	0.00	0.00	0.00	2.50	0.00	-

Table 4: Performance of Birds Fed Graded Levels of Goat's Rumen Digesta as a Replacement for Wheat Offal at the Finisher Phase (5-8 weeks)

	Diets					
Parameters	**1(0%)**	**2(25%)**	**3(50%)**	**4(75%)**	**5(100%)**	**SEM**
Daily Feed Intake(g)	92.81	93.15	93.94	92.23	91.28	1.23^{NS}
Daily Weight Gain(g)	33.43	34.38	33.18	31.45	31.30	0.97^{NS}
Feed Conversion ratio	2.78	2.71	2.84	2.95	2.92	0.09^{NS}
Mortality (Number)	1.00	0.00	1.00	1.00	0.00	-

Table 5: The Overall Performance of Birds fed Graded Levels of Goat Rumen Digesta as a Replacement for Wheat Offal (1 – 8 weeks)

treatments during the finisher phase. However, values observed for the birds fed the trial material were better and collaborated that of [5,6,10]. Mahmoud et al. (2015) also made similar observation after feeding dried rumen contents to broiler chickens.

Mortality

The mortality of chicks during the finisher phase indicated that only one chick was lost from diet 4 while no mortality was recorded in diets 1, 2, 3 and 5. There was no evidence of any disease regarding the death the chicks.

Overall performance

The overall performance was calculated from the respective performance during the starter and finisher phases. The daily feed intake, the daily weight gain and feed conversion ratio were not significantly affected by the treatment. GRD being source of dietary fiber, its incorporation at a moderate amount in the diets of broiler chickens improves their performance, these observations were similar to those of [1,11,12] who reported that incorporation of moderate amount of fiber in the diets of broilers may have positive effects on gizzard activity, gut motility and health by preventing adhesion of some pathogenic bacterial population to the epithelial mucosa and improving growth performance of non-ruminant animals.

Carcass characteristics

The results for the carcass characteristics were presented in Table 6. The dressing percentage ranged from 69.07 – 72.20% for birds on diets 5 and 2 respectively. However, all the parameters used for carcass measurement showed no significant difference between the treatment means except for the gizzard, spleen and gastrointestinal tract length. The gizzard and all the other internal organ weight were calculated as percentage of live weight. The gizzard

	Diets					
Parameters	**1(0%)**	**2(25%)**	**3(50%)**	**4(75%)**	**5(100%)**	**SEM**
Live weight (kg)	2.25	2.13	2.36	2.09	2.06	0.11^{NS}
Plucked weight (kg)	2.13	2.00	2.21	1.90	1.95	1.84^{NS}
Eviscerated wt (kg)	1.84	1.69	1.80	1.50	1.59	0.09^{NS}
Dressing percentage	71.52	72.20	69.30	67.47	69.07	1.72^{NS}
Gizzard (%)	1.76^{b}	2.07^{a}	1.81^{b}	1.80^{b}	1.80^{b}	0.06*
Liver (%)	1.45	1.56	1.67	1.44	1.46	0.10^{NS}
Lungs (%)	0.65	0.62	0.60	0.51	0.43	0.07^{NS}
Heart (%)	0.44	0.39	0.40	0.41	0.35	0.03^{NS}
Spleen (%)	0.08^{b}	0.09^{ab}	0.10^{a}	0.06^{c}	0.10^{a}	0.01*
Kidney (%)	0.32	0.36	0.33	0.35	0.33	0.04^{NS}
Pancreas (%)	0.32	0.38	0.42	0.39	0.36	0.04^{NS}
Abdominal fat (%)	1.47	1.36	1.42	1.53	1.59	0.37^{NS}
GIT (%)	2.95	3.21	3.20	3.18	2.68	0.18^{NS}
GIT length (cm)	205.12^{ab}	203.50^{ab}	212.12^{a}	203.38^{ab}	163.12^{c}	10.27*
Caecal length (cm)	19.50	19.75	20.50	20.63	20.38	1.37^{NS}

Note:^{abc} means in the same row with different superscripts differ significantly (* = P<0.05)

Table 6: Carcass Characteristics of birds fed Graded levels of Goat Rumen Digesta as a Replacement for Wheat Offal.

weight ranged between 1.76 – 2.07% for birds on diets 1 and 2 respectively. The percentage gizzard values on diets 3, 4 and 5 were similar and were all higher than the values on the control (1.76%).This observation was similar to those of Bello et al. (2011) who reported that the effect of dietary treatment on organs, tissues weight and body development may affect carcass characteristic of birds [14]. Mateos et al, (2012) reported positive effect of dietary fibre on gizzard, gut and performance of birds. Similarly Mahmoud, et al (2015) reported the improvement in the performance of birds fed moderate amount of dietary fibre.

Blood constituents are the bio-chemical medium of transportation in all animals and thus their status show the healthiness of the birds. The blood analysis (Table 7) showed non-significant effect of GRD incorporation for all the parameters considered. The PCV ranged from 22.00 – 25.50% for birds on diets 5

	Diets					
Parameters	**1(0%)**	**2(25%)**	**3(50%)**	**4(75%)**	**5(100%)**	**SEM**
Pack cell volume (%)	24.75	24.75	25.50	25.25	22.00	1.12NS
Haemoglobin (g/dl)	8.50	8.28	8.58	8.34	7.51	0.42NS
Total serum protein (g/dl)	3.15	3.75	3.55	3.71	3.71	0.32NS
Red blood cells (x1012/l)	320.75	257.25	322.50	294.75	251.25	31.58NS
White blood cells (x109/l)	3.03	2.83	2.93	2.95	2.79	1.12NS

Table 7: Haematological Parameters of Birds fed Graded Levels of Goat Rumen Contents as a Replacement for Wheat offal.

	Diets				
Parameters	**1(0%)**	**2(25%)**	**3(50%)**	**4(75%)**	**5(100%)**
Starter phase:					
Total feed intake (kg)	1.93	1.98	1.89	1.88	1.88
Feed cost (N/kg)	97.94	96.44	94.94	93.44	91.94
Total feed cost (N)	189.02	190.95	179.44	175.67	172.65
Total weight gain(kg)	0.69	0.74	0.71	0.71	0.68
Feed cost N/kg gain	273.94	258.04	252.73	247.42	254.19
Finisher phase:					
Total feed intake	3.27	3.25	3.37	3.29	3.23
Feed cost (N/kg)	85.55	83.60	81.65	79.70	77.70
Total feed cost (N)	279.75	271.70	275.16	262.21	250.97
Total weight gain(kg)	1.15	1.19	1.15	1.05	1.07
Feed cost N/kg gain	243.26	228.32	239.27	249.72	234.55
Overall performance:					
Total feed intake	5.20	5.22	5.26	5.16	5.11
Feed cost (N/kg)	91.75	90.02	88.30	86.57	84.82
Total feed cost (N)	477.10	469.90	464.46	446.70	433.43
Total weight gain(kg)	1.84	1.93	1.86	1.76	1.75
Feed cost N/kg gain	259.29	243.47	249.71	253.81	247.67
Cost saving	0.00	15.82	09.58	05.48	11.62

Table 8: Economic analysis of inclusion of goat rumen digesta as replacement for wheat offal in the diet of broiler chickens

and 3 respectively. The trend was similar for Hb, total serum protein, RBC and WBC. Akinfala et al. (2007) obtained similar results with cockerels fed processed cassava meal.

The cost effectiveness is one of the paramount issues on which the investigation of the low cost feed ingredients was based. The feed cost per kg gain in all the phases decreased with increasing level of GRD incorporation in the diet. It ranged from ₦243.47 – ₦259.29 for the birds on diets 2 and 1 respectively, at the overall phase (Table 8). There were cost savings on all the treatments during both starter and finisher phases. This observation was similar to the report of Kekeocha (1985) that a strong economic benefit exists for finding and alternative low cost feed material for poultry feed.

Conclusion

The result of the study have shown that Goat rumen digesta can be incorporated in broiler diet at 100% replacement level for wheat offal without adverse effect on performance, carcass yield and blood chemistry. However, 50% level is most economical. The use of rumen digesta in poultry diets reduced feed cost (₦/kg) and feed cost in naira per kg body gain, thereby improving the profit margin of the producer.

The use of rumen digesta can reduce over dependence on conventional feedstuffs and hence contributes to animal production, thereby improving the animal protein intake of the citizens and also ameliorating the health hazard cause by environmental pollutants.

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