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Growth Performance, Carcass Characteristics, Haematological Indices and Apparent Nutrient Retention of Broiler Birds Fed Enzyme-Supplemented High Fibrous Diets

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1: Abstract

The effects of supplementing high fibrous diets with Roxazyme G® enzyme on performance, carcass, haematology and digestibility parameters was investigated for 8 weeks using 200 day-old Agrited® broiler chicks. The birds were randomly allocated to ten dietary treatment groups of 20 birds each with two replications of 10 birds. Wheat offal was included into the ten diets at 0, 15, 20, 25 in the starter phase, and at 10, 20, 30 and 35% in the finisher phase. Enzyme inclusion levels in both phases were 0% and 0.02%. The findings of the study showed that broiler birds could tolerate up to 35% level of wheat offal in their diets when supplemented with exogenous enzyme.

2: Introduction

Wheat offal is a by-product of wheat after industrial processing, with appreciable amounts of essential minerals. Feeding wheat offal at high inclusion levels to broiler birds is however, often discouraged because it contains xylans and arabinoxylans as main soluble non-starch polysaccharides (NSP) contents. NSPs have been implicated in the reduction of wheat's nutritive value, due to its depressing effects on nutrient digestion and absorption (Amaefule *et al*., 2009; Loar *et al*., 2010). Addition of exogenous enzyme such as Roxazyme G® to broiler wheat offal based-diets can help break down the fibrous content of the feed, eliminate anti-nutrients, and improve nutrient digestibility and overall growth performance of the birds (Mateo *et al*., 2008). The present study was designed to evaluate the effects of addition of exogenous enzyme to wheat offal based diets on growth performance, haematology, carcass and apparent nutrient retention of broiler birds.

3: Methods and Materials

Dietary Treatments: Ten experimental starter and finisher diets were formulated to contain wheat offal at 0, 10, 15, 20 and 25% levels (starter diets), and at 0, 10, 20, 30 and 35% levels (finisher diets), Roxazyme G enzyme was included into the diets at 0% and 0.02% levels in both phases. Table 1 shows the composition of experimental starter diets.

Experimental birds and management: Two hundred unsexed day-old Agrited® broiler chicks were randomly divided into ten treatments groups of 20 birds each. Each group was replicated twice with 10 birds per replicate using a 5x2 factorial arrangement in a completely randomized design.

4: Data Collection

Performance: Initial weights of the birds was taken on the first day of the trial. Thereafter, the birds were weighed weekly until slaughter. Daily feed intake was computed. Data obtained from the average daily feed intake and average daily weight gain was used to calculate the feed conversion ratio.

Haematology and carcass analysis: At 56 day of age, blood was drawn from the wing vein of two birds per replicate into labeled sterile bottles containing EDTA and used for full blood count analysis. Two birds per replicate were also randomly selected and euthanized on day 56 according to standard practices. Following evisceration, carcass dressing percentage was calculated and the weights of visceral organs recorded.

Apparent digestibility trial: Two birds per replicate were selected at the 7th week for digestibility trial. Metabolism cages with detachable trays under each cage was used to house the birds. The birds were allowed an adjustment period of three days, given a known quantity of feed, and feaces collected for four days. Faecal samples obtained were analyzed for proximate contents (AOAC, 2006). Nutrient digestibility was then calculated using the formulae:

$$= \frac{\boldsymbol{nutrient\ intake - nutrient\ in\ excreta}}{\boldsymbol{nutrient\ intake}}$$

Statistical analysis: Data generated during the trial was subjected to analysis of variance for a completely randomized design using the SPSS (2011) package. Mean separation was done using Duncan's New Multiple-Range Test (Duncan, 2003), and significant differences declared at $P < 0.05$.

5: Results

Growth performance and carcass traits

- only the average daily feed intake (ADFI) of birds was significantly influenced ($p<0.05$) by dietary treatments. Addition of enzyme significantly ($p<0.05$) reduced ADFI across treatment groups, especially as the levels of wheat offal increased in the diets. Carcass and organ weights of birds were comparable ($p>0.05$) among birds on the different treatments (Table 2).

Haematology and digestibility

- Packed cell volume (PCV) was the only blood parameter that was significantly ($p<0.05$) affected by dietary treatments. Enzyme inclusion increased PCV at increasing wheat offal levels of 10, 30 and 35%. Apparent digestibility of dry matter and ash were significantly influenced ($p<0.05$) by dietary treatments. Enzyme supplementation significantly increased DM digestibility at 20 and 35%, and ash digestibility at 10, 30 and 35% levels of dietary wheat offal respectively (Table 3)

Table 1. Percentage composition of broiler starter wheat offal diets

Ingredients										
	1	2	3	4	5	6	7	8	9	10
Wheat offal (%)	0	0	10	10	15	15	20	20	25	25
Enzymes (%)	0	0.02	0	0.02	0	0.02	0	0.02	0	0.02
Maize	40.00	40.00	36.00	36.00	35.00	35.00	32.00	32.00	30.00	30.00
Soybean meal	34.77	34.75	34.77	34.75	33.75	33.72	34.77	34.75	33.75	33.72
Wheat offal	0.00	0.00	10.00	10.00	15.00	15.00	20.00	20.00	25.00	25.00
Palm kernel cake	18.23	18.23	11.23	11.23	7.25	7.26	3.23	3.23	1.25	1.26
Enzyme	0.00	0.02	0.00	0.02	0.00	0.02	0.00	0.02	0.00	0.02
Palm oil	0.00	0.00	1.00	1.00	1.50	1.50	2.50	2.50	2.50	2.50
Crude protein %	23.88	23.87	23.82	23.81	23.86	23.66	23.90	23.89	23.70	23.68
ME (Mcal/kg)	2.85	2.85	2.82	2.82	2.81	2.81	2.81	2.81	2.77	2.76
Crude fibre %	4.08	4.08	4.98	4.98	4.99	4.98	5.05	5.04	5.27	5.26

Ingredients: Fish meal; 2-2.5%, bone meal, 4%, salt, 0.25%, premix, 0.25%, methionine, 0.25%, lysine, 0.25%.

Table 2. Performance of broiler birds fed supplemented wheat offal diets

Treatment											
	1	2	3	4	5	6	7	8	9	10	SEM
WOL	0	0	10	10	20	20	30	30	35	35	
ENZL	0.00	0.02	0.00	0.02	0.00	0.02	0.00	0.02	0.00	0.02	
Ini.BW	57.04	51.04	55.16	57.54	54.78	57.49	51.71	52.64	52.28	54.29	0.26
Fin.BW	1605.0	1633.5	1490.0	1438.5	1267.5	1696.0	1087.5	1315.0	1225.0	1015.0	75.52
ADW	28.15	28.71	26.11	25.17	22.14	20.84	18.51	23.01	21.41	23.17	72.62
ADFI	69.73^{a}	70.13^{a}	66.90^{b}	67.93^{b}	63.53^{c}	64.11^{c}	61.73^{d}	61.88^{d}	60.79^{d}	61.86^{d}	43.19
FCR	2.48	2.44	2.56	2.70	2.86	3.08	3.33	2.69	2.84	2.67	0.21

^{a,b,c,g} Means on the same row with different superscripts are significantly different ($P<0.05$); SEM= Standard error of mean; WOL: Wheat offal levels (%); ENZL: Enzyme levels (%), Ini.BW: Initial body weight; Fin.BW: Final body weight; ADWG: Average daily weight gain; ADFI: Average daily feed intake; FCR: Feed conversion ratio.

Table 3. Haematology and apparent digestibility of broiler birds fed supplemented wheat offal diets

Treatment											
	1	2	3	4	5	6	7	8	9	10	SEM
WO (%)	0	0	10	10	20	20	30	30	35	35	
EnZL (%)	0.00	0.02	0.00	0.02	0.00	0.02	0.00	0.02	0.00	0.02	
Haematology parameters											
PCV (%)	37.50^{e}	40.50^{bcde}	40.50^{bcde}	41.00^{bcd}	38.00^{de}	40.00^{cde}	41.50^{abc}	41.50^{abc}	43.50^{ab}	44.50^{a}	0.51
HB (x106)	11.95	12.90	12.25	12.70	12.70	12.45	12.15	12.25	12.70	12.80	0.10
RBC (g/dl)	11.23	11.48	11.18	10.60	11.17	11.17	11.13	11.33	11.02	11.83	0.11
*WBC	1.25	1.22	1.26	1.18	1.24	1.25	1.26	1.32	1.23	1.26	1.00
Digestibility Parameters (%)											
Dry matter	86.49^{e}	86.74^{d}	85.04^{i}	86.13^{g}	87.05^{b}	87.33^{a}	86.03^{h}	86.32^{f}	87.02^{b}	86.83^{c}	0.02
Ash	35.42^{d}	48.53^{bc}	52.50^{ab}	53.57^{ab}	51.47^{ab}	40.0^{cd}	60.87^{a}	49.15^{bc}	40.0^{cd}	41.7^{cd}	3.65

Means with different superscripts, $^{a, b, c, d, e...i.}$ are significantly ($P<0.05$) different: SEM= Standard error of mean. WO: Wheat offal; *EnZL: Enzyme levels; PCV: Packed cell volume; HB: Haemoglobin; RBC: Red blood cell; *WBC: White blood cell (x10/mm^3).

6: Discussions

- As the levels of wheat offal increased in the diets, the feed intake of the birds declined, even with enzyme inclusion. Despite this decline in feed intake, birds on the enzyme supplemented and non-supplemented diets had similar average final body weights and average daily weight gain. This suggests that in spite the high levels of wheat offal in the diets, the birds were still able to utilize available dietary nutrients for tissue deposition.
- PCV was within normal range, suggesting that the health status of the birds were not unduly compromised by exposure to high levels of wheat offal in the diets.
- Ash digestibility was improved by addition of enzyme to the diets, suggesting that more minerals were available for the birds to utilize.

7: Conclusions

Broiler birds can tolerate up to 35% inclusion level of wheat offal in their diets when supplemented with exogenous enzyme.

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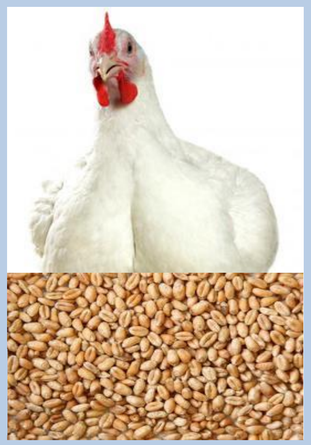

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