

COMMERCIAL ENZYME INFLUENCE ON BROILERS FED DIFFERENT LEVELS OF WHEAT

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Abstract: An experiment was conducted to evaluate the efficacy of multi-enzyme supplement (Natuzyne[®]) in diets containing wheat on the broilers performance. A total of one hundred twenty day old male broiler chicks (Arbor Acres) were randomly assigned to 6 treatments with a 2×3 factorial arrangement (0, 150 and 300 gram per kilogram wheat and 0 and 0.025 gram per kilogram enzyme). Chickens were fed with starter, grower and finisher diets during 1-21, 22-35, 36-49 days of the age, respectively. Body weight gain, feed intake, and feed conversion ratio were determined weekly and productivity efficiency index was determined at the end of experiment. Litter moisture was evaluated at the age 21 days. The results indicated that although different levels of multi-enzyme and wheat had no significant effect on body weight gain, feed intake, feed conversion ratio, productivity efficiency index and litter moisture but caused partial improvement in these parameters.

Key words: broilers, performance, multi-enzyme, wheat

Introduction

Wheat grains contain relatively high concentrations of non-starch polysaccharides (NSPs), which are indigestible by broilers. NSPs problems are due to their viscous nature, to the physiological and morphological effects on the digestive tract and to their interaction with the intestinal microflora (Gao *et al.*, 2007). There are two mechanisms proposed for the anti-nutritional effect of soluble NSPs. One mechanism refers to the fact that starch and protein in wheat endosperm are encapsulated by the cell wall NSPs. The second mechanism is related to higher digesta viscosity as a direct effect of soluble NSPs because the diffusion of the digestive enzymes is reduced (Amerah *et al.*, 2008). Enzyme supplementation of diets based on wheat can reduce the mentioned adverse effects (Bedford, 2000). Enzymes decrease the viscosity of gut contents, resulting in improvements in nutrient digestibility and performance when added to poultry diets (Marquardt *et*

al., 1994). The positive effects of supplementing NSP-hydrolyzing enzymes on soluble NSPs are related to lower jejunal viscosity values and a faster passage rate of the diet through the digestive tract, which may also limit the potential development of pathogenic microbes (*Bedford and Morgan, 1996*). The present study was conducted to investigate the effects of a commercial multi-enzyme on performance and litter moisture of broilers that fed by different levels of wheat.

Materials and Methods

Birds, housing and management: A total of one hundred twenty 1-d-old Arbor Acres broiler chicks (average 41 ± 0.3 g body weight) were randomly assigned to 6 treatments of 4 floor pen replicates. The birds were housed in deep litter pens and reared from day one to seven weeks. The temperature of the experimental room was maintained at $32 \pm 2^\circ\text{C}$ during the first week of trial and then reduced by 2°C each week till it reached 24°C which was maintained for the rest of the period. No vaccine was used in this experiment.

Experimental diets: 0 (Control group), 15 and 30% wheat and 0 and 0.025% multi-enzyme were added to diet, respectively. Commercial multi-enzyme (Natuzyne[®]) which used in this experiment was obtained from *Trichoderma longibrachiatum*. The complex was contained xylanase, cellulose, protease, α -amilase, pectinase, phytase, β -glucanase, amyloglucosidase, pentosanase and hemicellulase. Compositions of the basal diet and calculated nutrient levels for the experiment are presented in Table 1.

Data collection: Body weight gain (BWG), feed intake (FI), feed conversion ratio (FCR) were determined weekly and mortality was recorded when occurred. Productivity efficiency index (PEI) was determined at the end of experimental period. Litter moisture (LM) was evaluated at the age of 21 days. The samples of litter were taken off, dried at 70°C and weighted after 24 hours, and then samples moisture were evaluated.

Statistical Analysis: The experiment had a completely random design with a 2×3 factorial arrangement (analysis of variance, ANOVA, SPSS Inc., Chicago, IL): $Y_{ij1} = \mu + a_i + b_j + a_i b_j + e_{ij1}$, where Y_{ij1} is the observation of a chick fed the levels of wheat i and multi-enzyme inclusion j , a_i is the levels of wheat (0, 150, 300 gram/kg wheat) and b_j is the multi-enzyme inclusion (0, 0.025 gram/kg Natuzyne[®]), $a_i b_j$ is the interaction between levels of wheat and multi-enzyme inclusion and e_{ij1} is the error term. Duncan multiple range test was used to determine confidence intervals for all pair wise differences between means. The general linear model was used to determine the main effects of factors and any

possible interactions between factors. Significance was accepted at the $p < 0.05$ level.

Table 1. Formulation of the diet and estimated chemical composition of experimental rations

Experiment Period	Starter (1-21 Days)			Grower (22-35 Days)			Finisher (36-49 Days)		
	No wheat	15% wt. wheat	30% wt. wheat	No wheat	15% wt. wheat	30% wt. wheat	No wheat	15% wt. wheat	30% wt. wheat
Corn	45.55	32.52	20.53	49.96	37.93	35.93	54.34	42.31	30.29
Soybean meal	38.34	37.12	35.89	33.06	31.83	30.65	27.98	26.76	25.54
Wheat bran	7.59	5.82	4.06	7.64	5.88	4.00	7.58	5.82	4.05
Wheat	0	15.00	30.00	0	15.00	30.00	0	15.00	30.00
Oil	5.18	5.18	5.18	5.30	5.30	5.60	6.11	6.11	6.11
Di calcium phosphate	2.17	2.17	2.18	1.91	1.92	1.99	1.78	1.78	1.79
Calcium carbonate	0.98	0.97	0.96	0.91	0.90	0.85	1.02	1.01	1.00
L-methionine	0.19			0.20			0.20		
Lysine	0.14	0.17	0.20	0.15	0.19	0.25	0.07	0.10	0.14
Salt	0.37	0.35	0.33	0.37	0.35	0.33	0.43	0.43	0.43
Premix ¹	0.5			0.5			0.5		
Calculated Analysis									
M.E. (Kcal.Kg)	2850			2950			3050		
C.P.	22.5			20.0			18.0		
Lysine	1.38			1.25			1.05		
Methionine	0.539			0.526			0.493		
Methionine + Cystine	0.920			0.880			0.820		
Calcium	1.00			0.90			0.90		
P (available)	0.50			0.45			0.42		
Sodium	0.16			0.16			0.18		

¹supplied per kilogram diet: vitamin A= 9000 IU, vitamin D3= 2000 IU, vitamin B1= 18 IU, vitamin B3= 9.8 IU, vitamin B6= 2.9 IU, vitamin B12= 0.15 IU, vitamin E= 18 IU, vitamin K3= 2mg, vitamin B2=6.6 mg, vitamin B5 = 29.7 mg, vitamin B9= 1 mg, vitamin H2= 0.1 mg, Cholin chloride= 500 mg, Mn= 99.2 mg, Zn= 84.7 mg, Fe = 5mg, Co= 1mg, Se=0.2 mg, I= 0.992 mg

Results and Discussion

BWG, FI, FCR, PEI and LM did not significantly affected ($P > 0.05$) by different levels of wheat (Table 2). Diet supplemented with Natuzyme[®] had no significant effect on BWG, FI, FCR, PEI and LM ($P > 0.05$). Supplementation diets, including different levels of wheat, with Natuzyme[®] increased BWG partially in comparison with control diets. FCR and PEI also improved by multi-enzyme. Throughout the entire experiment the highest BWG was reported in diet with 0%

wheat plus Natuzyme[®], whereas birds received diet included 30% wheat without Natuzyme[®] had the lowest BWG. The highest FI and FCR were recorded in 0% wheat without Natuzyme[®] fed group, whereas birds received 15% wheat without Natuzyme[®] had the lowest FI and FCR. The chicks were fed with 30% wheat plus Natuzyme[®] and control (0% wheat + 0% Natuzyme[®]) diets had the highest and lowest PEI, respectively. Enzyme consumption in all of the treatments except the birds fed with 15% wheat with plus enzyme, decreased LM in comparison with diets with different level of wheat, without Natuzyme[®].

Table 2. Effect of different levels of wheat and Natuzyme in broiler diet on performance and litter moisture.

Treatments		BWG (gr)		FI (gr)		FCR (gr/gr)		PEI	Litter moisture (%)
Wheat (%)	Enzyme (%)	1-21 days	1-49 days	1-21 days	1-49 days	1-21 days	1-49 days	49 days	21 day
0	0	644.5	2728.5	964.0	5963.1	1.496	2.232	238.9	28
15	0	634.7	2673.4	958.3	5542.6	1.510	2.097	244.5	22
30	0	621.2	2662.8	954.0	5797.2	1.535	2.198	239.0	24
0	0.025	614.5	2765.0	986.8	5832.7	1.606	2.124	258.5	22
15	0.025	636.9	2697.8	965.1	5903.5	1.501	2.189	243.0	26
30	0.025	616.1	2710.8	936.7	5683.5	1.517	2.101	258.6	23
Pooled SEM		14.4	44.2	12.3	80.8	0.03	0.04	8.4	1
Probability									
Wheat		NS	NS	NS	NS	NS	NS	NS	NS
Enzyme		NS	NS	NS	NS	NS	NS	NS	NS
Wheat x Enzyme		NS	NS	NS	NS	NS	NS	NS	NS

NS: Not Statistically Significant; BWG: Body Weight Gain; FI: Feed Intake; FCR: Food Conversion Ratio; PEI: Productivity Efficiency Index = {[Body Weight (kg) × Livability (%)]/[Duration of Experiment (d) × Feed Conversion Ratio]} × 100; SEM : Standard Error of the Means

The results of this study showed that using of wheat in diet had no significant effect on BWG ($P>0.05$) although 15 and 30% wheat in diets decreased BWG by an average of 2.01 and 2.40 percent, respectively. This finding is in

accordance with other studies (*Silva et al., 2002; L'azaro et al., 2003; J'ozefiak et al., 2007*). Decreasing of BWG can be attributed to the presence of soluble arabinoxylans in wheat that they are generally believed to be responsible for the majority of the anti-nutritive activity of NSPs in poultry by virtue of their capacity to increase intestinal viscosity (*Choct and Annison, 1992*). Therefore, it is possible that the wheat used in this trail was situated in category of low NSPs wheat.

The present study showed that addition of Natuzyme[®] to diets with 15 and 30% wheat had no significant effect on BWG, but improved it slightly. At the end of experiment, BWG in broilers fed diets supplemented with enzyme were higher (1.77%) than broilers fed diets without enzyme that is in accordance with previous researches (*Engberg et al., 2004; Wang et al., 2005*). The positive influence of Natuzyme[®] on broiler performance has been explained by an improved digestibility (*Silva et al., 2002; L'azaro et al., 2003; J'ozefiak et al., 2007*). When xylanase adds to wheat based diet, a greater proportion of NSPs may be hydrolyzed. In addition xylanase can effectively reduce digest viscosity, presumably by cleaving the large molecules into smaller fragments. Therefore only high molecular weight soluble arebinoxylans are responsible for increased digest viscosity (*Bedford and Classen, 1992*). In this survey, Natuzyme[®] had no enough efficiency. This result might be caused by the presence of enzyme inhibitors or using different variety of wheat, and it is possible that level of wheat in the diet was low.

Using of 15 and 30% wheat in diets decreased FI, up to level of 7.1 and 2.8%, respectively. This is disagreement with the result of previous researches (*Silva et al., 2002; L'azaro et al., 2003; J'ozefiak et al., 2007*). In other hand, addition of Natuzyme[®] to diets including wheat increased FI partially (approximately 0.7%). This is in agreement with results of *Marron et al. (2001)* and *Gao et al. (2008)*, but this is disagreement with *Nejib et al. (2002)*, *L'azaro et al. (2003)* and *Yuben and Ravindran (2004)*. These differences among results may be caused by using different levels of wheat and enzyme. Insignificant effects of diets contain wheat on FCR and PEI may be due to use wheat with low NSPs that had a good quality and has no negative effect on broilers performance. In comparison with diets without enzyme, using enzyme in diets improved FCR (1.70%) and PEI (5.21%), nonetheless using enzyme supplementation had no effect. Whereas several researchers, *Yuben and Ravindran (2004)*; *Wang et al. (2005)*; *Gao et al. (2008)* reported that addition of xylanase to diets containing wheat improved FCR significantly.

In respect to the content of LM at 21 d, the enzyme did not significantly ($P>0.05$) affect this parameter. This result is in agreement with *leeson et al. (2000)*. Although, enzyme did not significantly affect LM, it had a decreasing trend. The reason of insignificant effect of enzyme on LM is not clear, but NSPs content may not be enough to affect this parameter significantly.

Conclusion

In conclusion, although NSPs-hydrolyzing enzyme preparations (Natuzyne®) in diets with different levels of wheat had no significant effect on broilers performance; it can improve it. This improvement is achieved through the enzyme's influence on digestion of broiler chick.

Uticaj upotrebe komercijalnih enzima na brojlere hranjene različitim nivoima pšenice

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Rezime

Eksperiment je izveden da se proceni efikasnost više enzimskih dodataka (Natuzyne®) u ishrani koja sadrži pšenicu na performanse brojlera. Ukupno sto dvadeset jednodnevnih muških brojlera Arbor Acres () je podeljeno na 6 tretmana sa 2 3 faktora (0, 150 i 300 grama po kilogramu pšenice; 0 i 0.025 grama po kilogramu enzima). Pilići su hranjeni sa starter, grover i finišer obrocima tokom 1-21, 22-35, 36-49 dana starosti, respektivno. Prirast telesne težine, unos hrane, i konverzija hrane su utvrđivani nedeljno a indeks efikasnost i produktivnost određen je na kraju eksperimenta. Vlažnost prostirke je ocenjena u uzrastu 21 dana. Rezultati su pokazali da različiti nivoi multi- enzima i pšenice nisu imali značajan uticaj na prirast telesne mase, unos hrane, konverziju hrane, indeks produktivnosti i efikasnosti, vlažnost prostirke, ali je registrovano delimično poboljšanja u ovim parametrima.

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