Effect of rice hull inclusion with and without enzymes on growth performance and digestive traits of broilers

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Abstract

In a twenty-one-day feeding trial, the effects of rice hulls inclusion with and without enzymes supplementation were determined on growth performance, and digestive traits of broilers. Total of 200 one-day-old male broiler chicks (Lohmann) were divided into 40 groups of five (5) birds each and randomly assigned to the four treatment diets in a completely randomized designed (CRD). The treatment diets were: 1) control diet (corn-soybean based) (C), 2) inclusion of 4% rice hulls in the diets (RH), 3) RH diet + phytase1750FTU/kg (RHP), 4) RH diet + phytase 175[illegible]FTU/kg + cellulase 500 unit/kg (RHPC). Inclusion of 4% rice hulls in the diets increased body weight gain (BWG) ($p<0.001$) and gave better feed conversion efficiency (FCE) ($p<0.05$) on broiler chickens at 21 d of age compared to those fed the control diets. Supplementation of phytase or phytase and cellulase did not enhance BWG or FCE. Feed intake was not affected by diets ($p>0.05$). In addition, inclusion of rice hulls in the diet increased jejunum weight ($p<0.05$), and addition of phytase decreased the weight of jejunum same as that in the control diet. The inclusion of 40 g/kg rice hulls in corn- soybean based diets induces a better growth performance of young broiler chickens. Addition of phytase or phytase and cellulase in a balanced diet did not improve growth performance but it affected jejunum weight. The mechanism in which the addition of enzymes reduced the jejunum weight was unknown.

Keywords : rice hulls, growth performance, jejunum weight, phytase, cellulase

Introduction

The incorporation of insoluble NSP (iNSP) in broiler diets could enhance healthy gut environment (Bao and Choct, 2010) and nutrients digestibility (González-Alvarado *et al*., 2010). González-Alvarado *et al*. (2010) suggested that a minimal amount of fibers in the diets might require for young broiler chickens. However, it was reported that interaction of one iNSP with other iNSPs, or with other cell-wall components can change the physical properties of an iNSP source (Hartini *et al*., 2003), so the benefit of one iNSP might not apply to the other iNSPs. Beside iNSP, phytase is usually used in broilers diets to improve broilers performance. The utilization of cocktail enzymes such as phytase+carbohydrase has been reported to increase the phytase efficacy in increasing broiler performance (Avila *et al*., 2012). Incorporation of hulls in the broilers diet affected the weight of gastrointestinal organs and length of small intestine (González-Alvarado *et al*., 2010). In this study the effects of rice hulls inclusion with and without enzymes supplementation in diets was investigated on growth performance and digestive traits of broiler chickens from 1 to 21 d of age.

Methodology

Diets used in the experiment were: 1) corn-soybean based diet as a control diet (C), 2) inclusion of 4% rice hulls in a diet (RH), 3) RH diet + phytase 1750 FTU/kg (RHP), 4) RH diet + phytase 1750 FTU/kg + cellulase 500 unit/kg (RHPC). All diets were formulated to be isocaloric and isonitrogen and and meet all nutrient recommendations of the NRC (1994) for boilers starter diets. All diets were provided as mash feed. A total of 200 one-day-old male broiler chicks (Lohmann) (initial BW of 54.56 ± 2.3 g) were randomly allocated to 40 cages with 5 birds per cage and 10 cages per treatment. Chick were given free access to both water and feed until 3 weeks of age. Cages were illuminated 24 h per day. Body weight and FI (g/b/d) were determined at 0 and 21 d of age. Feed conversion efficiency was obtained by dividing BWG by FI. Mortality was noted during the study. At 21 d of age, one bird from each of five replicates per treatment that had weights closed to the mean weight for the cage was selected for dissection. Small intestine and gizzard were weighed with and without content. The pancreas was also removed and weighed. The weight of empty gizzard, duodenum, jejunum, ileum, and pancreas was expressed as g/100 g BW, whereas length of duodenum, jejunum, and ileum was expressed as cm/100 g BW.

The experimental data were analyzed using one-way Analysis of Variance (SPSS 16.0, 2007). After a significant F test, Duncan's test was used to inspect differences among group means. Differences among groups means was confirmed at $p<0.05$.

Results and Discussion

The effects of diets on growth performance and relative weight and length of digestive organs of broiler chickens are presented in Table 1.

Table 1. Growth performance and relative weight and length of digestive organs of broiler chickens during the experiment (mean ± SEM)

	Control diet	RH	RH+phytase[1]	RH+phytase+ cellulase[2]	p-value
BWG (g/b/d)	28,60±0,396^{a}	32,43±0,686^{c}	29,26±1,00^{ab}	31,48±0,983^{bc}	**
FI (g/b/d)	39,57±0,671	40,24±0,999	37,56±0,897	38,70±1,309	ns
FCE (g/g)	0,728±0,014^{a}	0,807±0,007^{b}	0,781±0,023^{ab}	0,819±0,031^{b}	*
Weight of digestive organs (g/100 g BW)					
Gizzard	3,07 ± 0,23	3,25 ± 0,18	2,80 ± 0,15	3,36 ± 0,18	ns
Duodenum	1,08 ± 0,08	1,23 ± 0,07	1,15 ± 0,07	1,15 ± 0,09	ns
Jejunum	2,02 ± 0,11^{a}	2,48 ± 0,16^{b}	1,95 ± 0,14^{a}	2,18 ± 0,13^{ab}	*
Ileum	1,48 ± 0,13	2,04 ± 0,18	1,65 ± 0,17	1,84 ± 0,19	ns
Pancreas	0,05 ± 0,00	0,05 ± 0,004	0,05 ± 0,005	0,06 ± 0,004	ns
Length of digestive organs (cm/100 g BW)					
Duodenum	3,18 ± 0,11	3,49 ± 0,16	3,38 ± 0,13	3,50 ± 0,09	ns
Jejunum	8,20 ± 0,41	8,54 ± 0,35	8,06 ± 0,32	8,51 ± 0,31	ns
Ileum	8,60 ± 0,46	8,78 ± 0,43	8,52 ± 0,27	8,68 ± 0,30	ns

[1]1750 FTU/kg, [2]500 unit/kg, ns= not significantly different, *p<0.05,**p<0.01, ***p<0.001

The inclusion of 4% rice hulls in the diets markedly increased BWG ($p<0.01$), improved FCE ($p<0.05$) but had no effect on FI. No additional improvement in BWG and FCE were found by supplementation of enzymes. Our data agreed with those of González-Alvarado et al. (2007), who found that a minimal amount of fiber in the diet increased chick performance. However, Hetland and Svihus (2001) included 4% oat hulls in the diets found an increased in FI but not BWG. Differences in diet composition would exert different physical properties of the fiber (Hartini et al., 2003) which eventually influenced the utilization of nutrients in posthatch chicks (Noy and Sklan, 2002). The lack effect of phytase addition on growth performance supported the previous finding that the higher or the sufficient the dietary P level, the poorer the response to phytase (Bedford et al., 2016). The inclusion of 4% rice hulls increased the relative weight of jejunum ($p<0.05$), and addition of enzymes reduced the jejunum weight similar to the control diet. The increased in small intestinal weight in diets rich in cellulose was reported due to the thickening of the muscular wall of small intestine (Jamroz et al., 1992). The mechanism where enzymes reduced the weight of jejunum was unknown.

Conclusion

The inclusion of 40 g/kg rice hulls in broiler starter diets based on corn-soybean diets increased growth performance. The mechanism was suggested through improving nutrient utilization. Addition of phytase or phytase and cellulase in the RH diets did not affect growth performance but decreased relative weight of jejunum. The mechanism where enzymes supplementation reduced the jejunum weight was unknown. Cellulase supplementation did not increase efficacy of phytase on growth performance.

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