The effects of physical, chemical and enzymatic treatment on rapeseed meal N-digestibility and metabolizable energy in broilers and chick performance

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Abstract
One tube-feeding experiment according to (sibbald, 1976) and one growth experiment were designed to determine the effects of physical, chemical and enzymatic treatment on nitrogen (N) digestibility and true metabolizable energy (TME) of rapeseed meal (RSM) in broilers and broiler chicks performance. Test materials in tube-feeding experiment were untreated RSM, treated with autoclave, hydrochloric acid (HCL), sodium hydroxide (NaOH) and Grindazyme GP 15000. Tub-feeding experiment indicated that N-digestibility and TME of all treated RSM were similar to untreated RSM except autoclave treated RSM. On the basis of tube-feeding results one growth experiment was designed to investigate the optimum level of RSM treated with Grindazyme GP15000 on performance, breast, abdominal fat, pancreas, liver and gizzard weight for broiler chicks. Experimental diets were based on soya bean meal (control diet) which was replaced by (0, 10, 15, 20, 25 and 30%) enzyme treated RSM (0.5mg/kg DM). Over all live weight gains and feed intakes of all diets containing treated RSM were similar to untreated RSM. Results from this study indicated that up to 30% inclusion of enzyme treated RSM could be recommended for practical diet formulation.
Key words: rapeseed meal, enzyme treatment, tube-feeding, performance, broiler

Introduction

Rapeseed meal contains high quality protein, but its use in diets of monogastric animals, particulary poultry, has been limited by the relatively high level of fiber, resulting in low energy yield and less than optimum protein utilization (Slominski and cambell, 1990). RSM is a rich source of the sulphur amino acids, methionine and cystine. Also characterized as having a lower metabolizable energy level than that of other protein sources, such as soya bean meal. The lower apparent metabolizable energy (AME) is at least partially due to the higher fiber content of the meal but this does not appear to account for all of the differences (NRC,1994). The content of antinutrients, as glucosinolates, aromatic choline esters, phytate and dietary fibers, restricts the use of RSM in feeding sensitive animals. The negative effects of the antinutrients can be reduced or eliminated by plant breeding, proper processing or a combination of breeding and processing (Jensen, et al.,1995; Liu et al., 1995). With respect to glucosinolates the wide spread growing of double low rape (<20 mol glucosinolates /g seed) has greatly reduced the negative effect of glucosinolates on animal performance and health (Sorensen, 1988). Several methods have been proposed as e.g. autoclaving (Zeb, et al., 2000), ammoniation (Paik, 1991), changes in desolventisation conditions (Shires, et al., 1983), irradiation (nugon-Baudon et al.,1988) etc. each with its merits and demerits.

Materials and Methods

Test material: RSM was the test material in tube-feeding and growth experiment and was obtained from a commercial supplier in Kermanshah (Nazgol factory). The RSM was treated with autoclave (120°C for 30 min.), 4.44 ml hydrochloric acid (HCL), 2.5 ml sodium hydroxide (NaOH) and Grindazyme GP 15000 (0.5mg/kg DM) enzyme was gift from Biochem Co.

Tube-feeding experiment: Forty two broilers with a range of weight between 2.75 to 2.95 kg were randomly allocated to one of five experimental untreated and treated RSM (autoclave, acid, alkali and enzyme treated) and to an endogenous-loss group (seven broilers/treatment) to evaluate the effects of different treatment of RSM N-digestibility and metabolisable energy.

Growth experiment: One hundred forty four mixed-sex Ross broiler chicks were randomly allocated to the six experimental diets. Experimental diets were based on soya bean meal (control diet) which was replaced by (0, 10, 15, 20, 25 and 30%) enzyme treated RSM (0.5mg/kg DM). Experimental diets were formulated according to National Research Council (NRC, 1994) recommendations and contained approximately 21% crude protein and 2950 Kcal metabolizable energy / kg. Each diet was replicated four times with six chicks per replicate. The experimental diets were fed in the form of a mash for a period of 28 days. Chicks were individually weighed at 7, 14, 21 and 28 days of experiment and the weight gain for each treatment was calculated on a daily basis. Feed intake was recorded at the same time. Feed was available *ad libitum* throughout the experiment. Water was also available at all times. At the end of the growth experiment two chicks from each cage killed by cervical dislocation. The breast, abdominal fat, pancreas, liver and gizzard were weighted.

Data from both experiments were subjected to ANOVA for completely randomized designs using SPSS software. Statistical significance of differences among treatments was assessed using the tukey's test.

Results and Discussion

Over the experimental period the general health of all chicks was observed carefully in both tube-feeding and growth experiments. Tub-feeding experiment indicated that there were no significant ($P>0.05$) differences in N-digestibility and TME of all treated RSM compare to untreated RSM except autoclave treated RSM. Results showed that N-digestibility and TME were significantly ($P<0.05$) decreased when RSM was treated by autoclave. Enzyme treatment of RSM improved numerically N-digestibility in tube-feeding experiment. A significant decrease in N-digestibility and TME for broilers tube-fed RSM treated with autoclave compared with untreated RSM, might be related to disruption of polypeptides structure because of wet heating temperature in autoclave for 30 minute. Slominski and Compbell (1990) reported that enzymatic treatment of RSM resulted to well-being digestibility of fiber part that included lignin and other non starch polysaccharides. In this experiment cell walls non starch polysaccharides of RSM has been covered by high concentration of ether extracts. Eggum (1981) was demonstrated that, there is negative relationship between fiber quantity of RSM and protein digestibility.

In the growth experiment all diets were intended to be isoenergetic and isonitrogenous, and were formulated from same ingredients. There were no significant ($P>0.05$) differences in over all live weight gains and feed intake between chicks fed the enzyme treated RSM compared to chicks fed the control diet. Average daily live weight gain among experimental diets ranged from 28.83 till 47.16g. Live weight gain was highest in control diet group compared to the other groups. The lowest live weight gain was observed in diet containing 20% RSM. Feed intake ranged from 69.95 till 91.42 g/d. The group fed diet containing 20% RSM had the lowest feed intake compared to other experimental diets. Overall, replacement of 30% RSM had a same response to improvement in performance of chicks compared to untreated RSM. Findings of the present study are in agreement with Zeb and Sattar (2002); Tadell and Almue (2003). In their study obtained same results of live weight gain. Lesson et al., (1987) observed high quantities of feed intake by broilers in 25 and 38% level of RSM. This study indicated that there were no significant ($P>0.05$) differences in breast, abdominal fat, pancreas, liver and gizzard weight for broiler chicks.

Table 1: Overall live-weight gains (g/day) and feed intakes (gDM/day) of chicks fed diets containing different level of enzyme treated RSM and non-enzyme treated RSM during 28 days of growth experiment.

		Level of enzyme treated RSM replacement					
	Untreated RSM	10%	15%	20%	25%	30%	SEM
Weight gain	47.16	37.33	35.61	28.83	42.21	41.43	3.635
Feed intake	91.41	80.37	76.58	69.95	83.78	84.78	6.083

Conclusion

Tube-feeding was a good model for evaluating feed enzymes.

The present experiment provides evidence that treatment of RSM with exogenous enzyme improved its nutritional value.

Enzyme treatment of RSM may be a potential method for improvement of RSM nutrient.

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