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Effect of Feeding High Sunflower Extraction Based Diets on Intestinal Viscosity and Performance of Broilers

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Key words: NSP = Nonstarch Polysaccharide, SFE = Sunflower Extraction, FI = Feed Intake, FCR = Feed Conversion Ratio, cPs = centipoises

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Abstract: Soybean meal was replaced by Sunflower Extraction (SFE) at 0, 10 and 20% levels on isonitrogenous basis in commercial broiler diets. The energy levels of diets containing 10 and 20% were less by 3.6 and 7.1%, respectively compared to 0% SFE. The experiment contains three treatment groups with three replicates of 20 chickens each. The study was carried out for a period of 6 weeks. Performance, litter moisture and the relative viscosity of intestinal contents were recorded. Body weight of chicks fed 10 and 20% SFE was significantly ($p \leq 0.05$) reduced at 2nd week. FCR was significantly ($p \leq 0.05$) high in 2nd week old chicks fed 20% SFE. Decreased performance of 2nd week old chicks was attributed to numerical increase in relative viscosity of gut contents, however, the increased viscosity did not affect the performance of broilers after 2nd week. The study suggests that older birds can better tolerate detrimental effects of viscosity of gut contents. Thus, SFE can be safely included up to 20% in broiler diets without affecting growth and performance.

INTRODUCTION

Poultry industry has made rapid strides in the last two decades leading to higher feed prices especially protein supplements. This has been a setback for further development. Sunflower is the fourth largest oil seed produced and used in the feed industry. Sunflower meals are generally used as a partial replacement for soybean meal in poultry feeds. High fiber and low lysine content has limited its use at higher levels in the feed. Increasing market price of protein supplements necessitated inclusion of SFM at higher levels in poultry feed. Major anti nutritional factors present are Non-Starch Polysaccharides (NSP) which increases intestinal viscosity affecting the performance of the birds. *In vitro* studies revealed that fiber degrading enzymes have reduced relative viscosity in SFE based diets (Malathi and Devegowda, 2001). However, information available is scanty with regard to study of intestinal viscosity in broilers fed diets containing higher levels of SFE *In vivo.*

Supplementation of exogenous enzymes to diets containing sunflower extraction has improved performance of broilers which was attributed to improved nutrient digestibility (Rao and Devegowda, 1996). It is generally accepted that adult birds are less affected by the presence of NSPs in the diet. Therefore a study was under taken to study the effect of broiler diets containing 0, 10 and 20% SFE on performance and relative viscosity of gut contents.

Table 1: Ingredients composition and calculated analysis of basal diets

	Diets (%)		
Ingredients	1	2	3
Maize	66	61	56
Soybean meal	31	26	21
Sunflower extraction	0	10	20
Mineral mixture	3	3	3
Salt (g)	300	300	300
Vit. AB2D3K (g)	15	15	15
B-complex vitamins (g)	20	20	20
Monocox (g)	50	50	50
Choline chloride (g)	100	100	100
Calculated analysis (%)			
Metabolisable energy, Kcal kg^{-1}	2972	2817	2712
Crude protein	19.76	19.87	19.98
Crude fiber	3.84	5.99	8.14
Lysine	1.02	0.97	0.92
Methionine	0.43	0.41	0.40

1.Provides per kg: Ca: 9000, P: 2700, Zn: 120, Cu: 15, Mn: 120, I: 3, Fe: 60, Se: 1.35; 2. Provides per kilogram of diet: Vit. A: 12375 IU, Vit. D3: 1800 IU, Riboflavin: 7.5 mg, Vit.k: 1.5 mg; 3. Provides per kg: Vit. E: 8 mg, Thiamine:0. 8 mg, Pantothenic acid: 8 mg, Pyridoxine: 1.6 mg, Niacin: 12 mg and Vit, B-12: 8 mcg; 4. Contained 1% maduramycin as active ingredient; 5. Contained 60% choline chloride on vegetable carrier

MATERIALS AND METHODS

Experimental design and birds: The 180 day-old broiler chicks were randomly divided into three equal groups. Each group had three replicates with 20 chicks. Three diets contained 0, 10 and 20% SFE were fed to all the groups. The diets had equal level of crude protein but ME level of diets with 10 and 20% SFE was less by 3.6 and 7.1%, respectively compared to diet containing 0% SFE. Feed formulation of starter and finisher was carried as per BIS. (1992) specifications (Table 1). The chicks were reared up to 6 weeks on deep litter system with standard manage mental practices and birds were fed *ad libitum*.

Data collection

Growth performance: Weekly body weight and FCR were recorded to evaluate the performance. In addition, litter moisture, mortality; relative viscosity of intestinal contents was measured on 14th and 28th day.

Intestinal viscosity measurement: Two birds (male and female) from each replicate were selected and sacrificed by injecting thiopentone sodium@25 mg kg^{-1} body weight. Gut contents were quickly poured to screw-capped tubes containing 10 mL-distilled water. The samples were immediately centrifuged@ 10000 g for 15 min and relative viscosity of the digesta supernatant was measured using Ostwald U-tube (Choct and Annison, 1992).

Statistical analysis: The results were analyzed using Fortran.stop.77 programme under randomized complete block design according to Snedecor and Cochran (1968). Differences between means were tested using 'F' test at a significance level $p \leq 0.05$.

Table 2: Effect of high sunflower extraction based diet on performance of broilers

	Body weight (g) (Weeks)			FCR (Weeks)		
Levels of SFE	2	4	6	2	4	6
0	277^{c}	842	1691	1.38^{a}	1.79	1.95
10	256^{a}	839	1705	1045^{abcd}	1.85	2.04
20	258^{a}	838	1652	1.54^{bcde}	1.92	2.13

Means within a column with unlike superscripts differ significantly ($p \leq 0.05$)

Table 3: Effect of high sunflower extraction based diet intestinal viscosity and litter moisture of broilers

	Relative viscosity (cPs) (Weeks)		Litter moisture (%)
Levels of SFE	2	4	6 weeks
0	1.40	1.38	36.27
10	1.46	1.39	37.60
20	1.69	1.46	38.74

Means within a column with unlike superscripts differ significantly ($p \leq 0.05$)

RESULTS AND DISCUSSION

Inclusion of SFE at 10 and 20% did not affect body weight gain significantly both at 4th and 6th week, respectively (Table 2). However, body weight of chicks fed 10 and 20% SFE was significantly ($p \leq 0.05$) reduced at 2nd week. FCR was significantly ($p \leq 0.05$) high in 2nd week old chicks fed 20% SFE when compared to 0% SFE. The relative viscosity of intestinal contents and litter moisture increased with the proportionate increase in SFE levels (Table 3).

The reduction in body weight and increase in FCR of chicks fed 10 and 20% SFE was attributed to decreased levels of ME at both 10 and 20% SFE (Zatari and Sell, 1990; Mushraf, 1991; Viera, 1992). Decreased body weight as well as FCR at 2nd week chicks fed diets containing 10 and 20% SFE was attributed to numerical increase in gut viscosity of young chicks (Ramesh *et al.*, 2006). The increased relative viscosity may be due to higher levels of NSPs present in SFE (Malathi and Devegowda, 2001) which affects the growth.

The relative intestinal viscosity has deleterious effect on growth of young chicks. The NSPs have a long insoluble chain and a side chain which soluble in nature (Choct and Annison, 1992). Solubility is an important factor which decides anti nutritive property. Soluble NSPs hold more water in the intestine. NSPs also increase viscosity of digesta and reduces rate of passage of digesta which leads to wet sticky droppings in chicks. Increased viscosity acts as a barrier and reduces contact between endogenous enzymes and nutrients thus reducing digestibility of proteins, lipids and starch. These effects together pose major problem in early part of chick life.

Solubility and degree of branching of NSPs are directly related whereas ages of bird and particle size of feed are inversely related to viscosity of digesta (Bedford, 1996).

CONCLUSION

However, numerical increase in relative intestinal viscosity as well as litter moisture did not affect the growth performance after 2nd week. This also suggests that older birds can tolerate high fiber content than young chicks. The deleterious effects of NSPs are minimal in older birds due to physiological changes that take place in the intestine. Patho-physiological studies are required to understand intestinal epithelium at different age group fed higher SFE. This study clearly suggests that inclusion of SFE up to 20% did not affect the relative viscosity of intestinal contents, litter moisture and growth performance of broilers.

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