



Effect of replacing fish meal and ground nut cake by doc soya on weight gain, digestibility and blood biochemical profiles in growing pigs

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Received: 05-10-2015

Accepted: 03-02-2016

DOI:10.18805/ijar.10275

ABSTRACT

The present study was carried out on 36 growing piglets to evaluate the possibility of soybean meal as protein source in place of fish meal (FM) and ground nut cake (GNC) in feed mixture. The diets were prepared by replacing the 100% FM by DOC Soya (T_2) and 100% replacing both FM and GNC by DOC soya (T_3) of basal diet (T_1). Significantly higher daily weight gain in growing piglet during the experimental period of 91 days was recorded in T_3 (0.46 ± 0.04 kg) and T_2 (0.43 ± 0.04 kg) than T_1 (0.35 ± 0.04 kg). CP and NFE digestibility were higher in group T_3 followed by T_2 and T_1 , the value being 67.00 and 75.60%, 74.76 and 80.81% and 78.89 and 84.83%, respectively. The balances of N, Ca and P were in positive direction and were higher in T_3 than T_2 and lowest in T_1 . Hematological indices were also higher in T_3 followed by T_2 and T_1 .

Key words: Blood biochemical profiles, Digestibility, Growth, Pig, Soybean.

INTRODUCTION

Soybean (*Glycine max*) is one of the world's largest sources of plant protein and oil. Soybean protein has high crude protein and a balanced amino acid profile most of which tend to be deficient in cereal grains which constitute large portions of diets of monogastric animals. Soybean meal, a byproduct of the oil milling industry also has rich nutritive value when compared to other protein sources. Relatively high crude protein content of soybean ranging from 44 to 48 per cent. Soybean meal also contains considerably higher energy and lower fiber content than other oilseed meals. The high concentration of protein and energy, and the low fiber content make soybean meal an ideal feed ingredient in formulating balanced rations that provide optimum growth, production and reproductive performance of monogastric animals. Among the oilseed feed ingredients, soybean meal is the most digestible with its amino acid digestibility values ranging from 83 to 93% for Cysteine and Phenylalanine, respectively. Other factors that have favoured the use of soybean in animal production include (1) consumer food safety concern of the inclusion of animal source protein in animal feeds, especially after the mad cow disease or bovine spongiform encephalopathy (2) limited production of animal source proteins such as fish meal and (3) the high cost of the animal protein sources such as fish meal and meat and bone meal.

MATERIALS AND METHODS

The present study was carried out on 36 growing pigs aged 2 to 3 months maintained at Pig Breeding Farm of Ranchi Veterinary College, Birsa Agricultural University,

Kanke, Ranchi (Jharkhand) during 2009. They were randomly divided and allotted to 3 treatment groups i.e. T_1 , T_2 and T_3 having 12 pigs in each. The experimental diets are prepared by replacing the FM protein and GNC of basal diet by DOC soya on iso-nitrogenous and iso-caloric basis as far as practicable.

- T_1 Basal diet (control) contains fish meal and GNC.
- T_2 100% replacement of fish meal of basal diet by DOC soya
- T_3 100% replacement of fish meal and GNC of basal diet by DOC soya

The ingredient composition of various feeds offered to experimental animals is presented in Table 1. The experiment was conducted for a period of 91 days. The weighed amount of respective feed was offered to each group twice daily at 8.00AM and at 4.00PM. All pigs were weighed at 14 day interval during the entire experiment. Daily gain in body weight was calculated to determine the growth pattern. At mid (45-50 days) of the experiment a metabolism trial of 5 days was conducted. All pigs were kept individually in specially designed metabolic cages to collect feed, faeces and urine. These samples were analyzed for N, Ca and P balances. The feed, faeces and urine samples were analyzed according to AOAC (1990). The blood samples were collected from all pigs at 91st days. About 6 ml of blood was collected aseptically from each pig. Hemoglobin, packed cell volume (PCV) and total erythrocyte count (TEC) were performed as per the method described by Jain (1986). Serum samples were analyzed for total serum protein, serum albumin, serum globulin, albumin: globulin ratio, cholesterol, in Spectrophotometer (Erma Inc. of Tokyo, Japan, AE-11M)

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Table 1: Ingredient composition (kg) of different diets.

Ingredients	T ₁	T ₂	T ₃
Crushed maize	55.0	55.0	55.0
Rice Police	20.2	20.6	22.0
G.N. Cake	20.0	13.6	-
Fish meal	4.0	-	-
DOC soya	-	10.0	22.20
Salt	0.3	0.3	0.3
Mineral mixture	0.5	0.5	0.5
Total	100.0	100.0	100.0

and U.V. Spectrophotometer (Safas of Monaco, 4606) by using diagnostic kits (Bayer Autopk biochemistry kits - Baroda, Span Diagnostics Ltd. – Sachin, Lab-care Diagnostics Pvt. Ltd.- Sarigam) as per the methods recommended by manufacturer. Serum globulin (g/dl) was calculated by subtracting the albumin values from the values of total serum protein. The data was analyzed statistically (Snedecor and Cochran, 1994).

RESULTS AND DISCUSSION

The growth performance of pigs from the first day of experiment upto 91 day at biweekly interval was recorded and presented in Table 2. Significantly higher daily weight gain in growing piglets during the experimental period of 91 days was observed in T₃ (0.46±0.04 kg) and T₂ (0.43±0.04 kg) than T₁ (0.35±0.04 kg). However difference between former two groups was nonsignificant statistically.

Kumar *et al.* (2000) also reported slightly higher growth rate in 100% replacement of FM-N by treated soybean in pigs diet during growing stage. The present findings are in conformity with Himanshu *et al.* (2004) who recorded significantly higher body weight gain in cockerel maintained on replacing 25 and 50% FM of control ration by full fat soybean. Vandergrift *et al.* (1983) made a similar observation in an experiment in which the intake and nutritive values of soybean meal and GNC were compared. Adeyemo and Longe (2007) also reported higher body weight gain in broiler feeding soybean meal. Although there was no significant difference in the values of weight gain obtained, the decrease in weight gain as the GNC level increased in

Table 2: Average daily weight gain (kg) in different dietary groups of pigs

Periods (days)	T ₁	T ₂	T ₃
0-14	0.24±0.03 ^a	0.44±0.03 ^b	0.46±0.01 ^b
15-28	0.37±0.03 ^a	0.39±0.02 ^a	0.50±0.02 ^b
29-42	0.46±0.03 ^a	0.54±0.02 ^a	0.52±0.03 ^a
43-56	0.37±0.02 ^a	0.42±0.03 ^a	0.54±0.03 ^b
57-70	0.42±0.04 ^a	0.49±0.03 ^a	0.46±0.02 ^a
71-84	0.43±0.02 ^a	0.50±0.02 ^a	0.51±0.05 ^a
85-91	0.18±0.01 ^a	0.20±0.02 ^{ab}	0.25±0.02 ^b
Overall	0.35±0.04 ^a	0.43±0.04 ^b	0.46±0.04 ^b

Mean under same superscript did not differ significantly

the diet may be linked to the better amino acid profile found in soybean meal than in GNC. This is in agreement with the work of Oyenuga (1965) who reported that GNC protein contains large amount of essential amino acids but its nutritive value tends to be limited by its marginal tryptophan and threonine. Significantly higher weight gain in goats maintained on soybean hulls as protein source in comparison to palm kernel cake was also reported by Anigbogu (2004). Higher body weight might be due to the compounds called isoflavones in soybeans that improve growth and stimulate lean tissue synthesis in young pigs.

The average digestibility co-efficient of organic nutrient and nutritive value of various diets were studied and presented in Table 3.

The analysis of variance showed significant (P<0.05) effect of diets on CP and NFE digestibility, these were highest in group T₃ followed by T₂ and lowest in T₁ diet. There was no significant difference either between groups T₁ and T₂ or between groups T₂ and T₃. However, a significant difference could be recorded between groups T₁ and T₃. This shows that replacement of fish meal and GNC by soybean meal increased the levels of available energy and DCP in the diets. It might be due to fact that the true ideal digestibility coefficients for most amino acids in soybean meal are higher compared to other protein sources (NRC, 1998). So, the amino acids in soybean meal are highly digestible relative to other protein sources, resulted into increased efficiency of amino acid utilization. Soybean meal is a rich source of lysine, the first limiting amino acid in most commercial swine diets. Because lysine is first limiting, the ratio of lysine to total protein is a crude measure of protein quality in feed ingredients. This high lysine content enables soybean meal to be a good complement to cereal grains commonly fed to swine. Where as its effect had non-significant influence on DM, CF, EE and OM digestibility. Adeniji (2007) reported that decrease in retention of protein, fiber and fat as GNC level increased in the diet suggests that these nutrients in GNC are not as available as they are in SBM. Non significant effect of diet on nutrient utilization in goats was also reported by Anigbogu (2004). Khan *et al.* (1998) reported significantly higher OM and CP digestibility in soybean meal than sesame cake diet in goats.

Table 3: Average digestibility co-efficient of organic nutrient and nutritive value different dietary groups of pigs

Particulars	T ₁	T ₂	T ₃
DM (%)	71.20±2.13 ^a	74.30±3.88 ^a	78.17±3.93 ^a
Crude protein (%)	67.00±2.30 ^a	74.76±3.55 ^{ab}	78.89±3.54 ^b
CF (%)	38.84±2.51 ^a	37.87±1.34 ^a	40.09±1.62 ^a
EE (%)	64.23±3.99 ^a	67.13±3.43 ^a	71.23±3.55 ^a
NFE (%)	75.60±2.77 ^a	80.81±2.82 ^{ab}	84.83±2.21 ^b
OM (%)	73.14±2.68 ^a	77.46±3.09 ^a	80.78±3.08 ^a

Mean under same superscript did not differ significantly

Table 4: Balance study nitrogen, calcium and phosphorus different dietary groups of pigs

Av. Nitrogen balance in various groups			
Particulars	Treatment groups		
	T ₁	T ₂	T ₃
Nitrogen intake (g/day)	29.88±2.11	30.88±1.91	31.17±2.79
Nitrogen voided			
Faeces (g/day)	9.86±1.12	7.79±0.91	6.58±1.32
Urine (g/day)	4.48±0.45	4.01±0.41	3.74±0.34
Total (g/day)	14.34±1.31	11.81±1.23	10.32±0.99
Nitrogen retention (g/day)	15.54±1.12 ^a	19.07±1.49 ^{ab}	20.85±1.21 ^b
Nitrogen retention as % of N-intake	52.00	61.76	66.89
Av. Calcium balance in various groups			
Ca- intake (g/day)	9.98±1.23	9.06±1.41	9.75±0.92
Ca- voided			
Faeces (g/day)	3.89±0.34	3.44±0.59	3.51±0.31
Urine (g/day)	1.59±0.17	1.40±0.23	1.47±0.12
Total (g/day)	5.48±0.56	4.84±0.67	4.98±0.71
Ca-retention (g/day)	4.50±0.49	4.22±0.73	4.77±0.31
Ca-retention as % of N-intake	45.10	46.60	48.90
Av. Phosphorus balance in various groups			
P-intake (g/day)	7.53±1.01	6.95±1.03	6.96±0.99
P- voided			
Faeces (g/day)	3.09±0.38	2.29±0.34	1.95±0.31
Urine (g/day)	0.98±0.11	0.97±0.10	0.84±0.13
Total (g/day)	4.07±0.44	3.27±0.39	2.78±0.31
P-retention (g/day)	3.46±0.31	3.68±0.33	4.18±0.37
P-retention as % of P-intake	46.00	53.00	60.00

Mean under same superscript did not differ significantly

The change in nutrient balance pertaining to N, Ca and P due to the different types of diet is presented in Table 4. It has been noted that all balances were in positive direction in pigs. N balance was significantly higher in T₃ as compared to T₁ and it varied from 52.00% (T₁) to 66.89% (T₃). Calcium and phosphorus balance was also higher in T₃ group but they were non significant to each other.

Hematological profiles are good indicators of health and disease conditions in farm animals; consequently blood

samples were analyzed to ascertain whether the dietary treatments had any effects on the blood profile of the pigs. Most of the hematological indices recorded in the present experiment are presented in Table 5 which are within the normal range and are non significant influence on the RBC, WBC, Hb and PCV value but they were higher in T₃ group followed by T₂ and T₁. Alada *et al.* (2004) also found similar trend on hemoglobin (g/dl) in rats fed soybean diet. Adeyemo and Longe (2007) also reported non-significant effect on RBC count in broilers fed on soybean meal. Church *et al.* (1982) observed that hematological traits especially PCV and Hb values are correlated with the nutritional status of the animal and the influence of diet on hematological trait is very strong. Adedeji *et al.* (2006) also found non-significant influence on haematological parameters in rabbit.

Table 5: Hematological and biochemical parameters of different dietary groups of pigs

PARAMETER	T ₁	T ₂	T ₃
RBC (x 10 ⁶ /μL)	4.49±0.49	4.99±0.81	5.12±0.99
WBC (x 10 ³ /μL)	12.91±1.11	13.12±0.94	14.26±0.91
Hb (g/dL)	12.66±0.92	13.17±0.43	13.82±1.27
PCV (%)	36.21±1.91	37.41±2.10	38.00±2.21
MCV(fl)	80.64±7.19	74.96±4.74	74.21±7.41
MCH (pg)	23.74±3.09	22.38±1.12	23.08±1.29
MCHC(%)	29.43±3.21	29.85±1.37	31.10±1.04
Total Protein (g/dl)	6.81±0.13 ^a	7.45±0.62 ^{ab}	7.81±0.29 ^b
Albumin (g/dL)	2.93±0.13 ^a	3.29±0.27 ^{ab}	3.42±0.13 ^b
Globulin (g/dL)	3.88±0.23	4.16±0.31	4.39±0.29
Albumin Globulin ratio	1:0.76	1:0.79	1:0.78
Total cholesterol (mg/dl)	115±2.62	113±2.34	112±2.49

Mean under same superscript did not differ significantly

On the other hand diets have significant influence on total protein and albumin. Total protein was significantly higher in T₃ group (7.81±0.29 g/dl) than T₁ (6.81±0.13 g/dl). However, T₂ (7.45±0.62 g/dl) did not differ significantly neither from T₁ nor from T₃. Similar trend was noticed in albumin also (Table 4). Adeyemo and Longe (2007) also found similar trend on total serum protein and serum albumine in broilers fed on soybean meal. The significant increases in the total plasma protein and plasma albumin levels also observed in rats fed soybean diet (Alada *et al.*, 2004).

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