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EFFECT OF DIFFERENT LEVELS OF CANOLA MEAL ON BROILER PRODUCTION PERFORMANCE DURING TWO PHASES OF GROWTH

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ABSTRACT

This study was conducted to investigate the effect of canola meal in broiler diets during starter (0-4 weeks) and finisher (5th week) phases of growth. For this purpose, 1905 day-old broiler (Star bro) chicks were reared in an environmentally controlled house using completely randomized design. Five different isonitrogenous and isocaloric experimental pelleted diets were prepared with five levels viz. 5, 10, 15, 20 and 25% of canola meal (containing 85% KOH solubility and 36% crude protein), designated as A, B, C, D and E, respectively, for starter phase. Five corresponding finisher diets were used during the finisher phase. The chickens were randomly allocated to five dietary treatment groups having three replicates of 127 birds in each group. Feed intake during 0-4 weeks of age was reduced ($P<0.01$) in chickens fed diets with increasing level of canola meal, whereas, non-significant difference ($P>0.05$) was found during 5th week of age. Weight gain was higher in chickens fed diets containing 25% canola meal during two stages of growth but difference was not significant ($P>0.05$) among the treatments. Similarly, during starting phase, feed utilization efficiency was better ($P< 0.01$) in chickens fed diet containing 25% canola meal compared to all other treatment groups, however, this difference was non-significant ($P>0.05$) among the treatments during finishing phase. Dressing percentage and relative weight of liver of chickens among all treated groups were similar ($P>0.05$). The results indicated that maximum inclusion of canola meal (25%) in broiler diets reduced the relative cost per unit weight gain. It may be suggested that canola meal (with 85% KOH solubility) can be incorporated upto 25% in broiler diets without any adverse effect on production parameters during starting and finishing stages of growth.

Key words: Canola meal, broiler starting phase, broiler finishing stage, chickens performance.

INTRODUCTION

Feed cost of poultry production usually ranges between 65 and 75 percent of the total production cost (Haq and Akhtar, 2004). Therefore, nutritionists are giving more attention to explore low cost and good quality ingredients for poultry rations. The vegetable proteins are the major protein source in poultry feed. Their inclusion to poultry feed is 28% and accounts for about 33.5% of total feed cost in commercial poultry (Sarwar *et al*., 2002).

Pakistan is facing shortage of the edible oil due to which it is imported every year. Government has decided to import canola (*Brassica napus* or *Brassica compestris*) as such for extraction of oil within the country. The oil component of canola seed contains <2% erucic acid and the solid component contains <30 micromoles of glucosinolates per gram of air dry, oil free solid (Campbell *et al*., 1981). Canola is an improved variety of rapeseed which has been developed through plant breeding by the Canadian scientists (Thomas and Reichert, 1986). Nowlin (1991) has reported that canola oil is now the world's third large source of edible oil after soybean and palm oil. On account of its better oil quality than other vegetable oils, canola was cultivated in Pakistan on 1,22,000 acres of land resulting in the production of 73,000 tones of seed and 29,000 tones of oil during 2001-2002. These figures rose to 2,23,000 acres, 1,36,000 tones and 52,000 tones, respectively, in 2003-04 (Economic Survey, 2003-2004). It appears that canola will replace major area under cultivation of rapeseed in near future. The byproduct obtained from the processing of canola seed is canola meal, which can be used in the poultry industry.

The canola meal is cheaper and used in a limited quantity in poultry feed, but its level can be increased to reduce the cost. The present project was designed to investigate effects of different levels of canola meal on production performance of broiler chickens during starter and finisher phases of growth.

MATERIALS AND METHODS

Experimental birds

A total of 1905 day-old broiler chickens (Star bro), having 44 g average body weight, were randomly divided into 15 separate floor pens (each 10x15 feet), each comprising 127 chicks and three pens (replicates)

per treatment group following completely randomized design. The experimental house was thoroughly cleaned and disinfected before the arrival of chicks. Experimental chickens were maintained under standard managemental conditions for 35 days in an environmentally controlled poultry house. The brooder temperature was maintained at about 95°F upto 7 days of age and gradually decreased to75°F by 21st day of age, after which the chickens were kept at room temperature.

The experimental chicks were fed broiler starter from day-old to four weeks and broiler finisher rations in the fifth week *ad libitum.* The birds had free access to feed and clean drinking water. All the chicks were vaccinated against Newcastle disease, hydro-pericardium syndrome and infectious bursal disease.

Experimental diets

Five isonitrogenous and isocaloric broiler starter and finisher diets in the form of crumbs and pellets were prepared (NRC, 1994). Canola meal and all other ingredients were purchased from the local market after analyzing each consignment randomly at the Feed Testing Laboratory of Islamabad Mills, Islamabad. Five different levels of canola oil meal (containing crude protein 36% with 85% KOH solubility) viz. 5, 10, 15, 20 and 25% were used in both the broiler starter and finisher diets (Tables 1 and 2) fed to experimental groups A, B, C, D and E, respectively. Each diet was analyzed as described by AOAC (2000) for proximate composition, minerals and aflatoxin at the Feed Testing Laboratory of Islamabad Feed Mills (Table 3). All analyses and determinations were done in triplicate. Experiment lasted for 35 days in May and June, 2005.

Parameters measured

Body weight gain and feed intake per pen were recorded at weekly intervals. The efficiency of feed utilization was calculated as feed intake per unit body weight gain. Daily mortality and etiology of the dead birds, if any, was recorded after conducting the post-mortem examination. At the termination of the experiment, three birds from each replicate were randomly selected, slaughtered and eviscerated to record carcass and liver weights. Liver weights were expressed in terms of relative weight (liver weight/kg pre-slaughter weight). Carcass weight was recorded after removing skin, head, feathers, lungs, feet and gastro-intestinal tract. Economic analysis of live weight gain of broiler chicks was calculated by deducting net expenditure cost of chicks from the gross income of the live weight gain.

Statistical analysis

The data obtained through this experiment were analyzed by using analysis of variance technique

Table 1: Composition (%) of broiler starter diets with different levels of canola meal

Ingredients	Diets*				
	A	B	C	D	E
Corn	19.99	20.03	20.00	20.00	19.99
Rice broken	10.00	10.22	16.00	16.00	16.00
Sorghum	5.00	5.01	5.00	5.00	5.00
Wheat	19.99	20.03	13.20	13.30	11.20
Rice polishing	7.00	7.01	7.00	7.00	7.00
Wheat bran	2.30	0.30	0.00	0.00	0.00
Corn gluten meal 60%	1.00	1.00	1.00	1.00	1.00
Corn gluten meal 30%	0.50	0.50	0.50	0.50	0.50
Canola meal	5.00	10.00	15.00	20.00	24.99
Sunflower meal	4.00	4.01	2.90	0.30	0.00
Guar meal	4.00	4.01	2.60	0.20	0.00
Soybean meal	12.30	9.02	8.00	8.00	5.10
Fish meal	4.00	4.01	4.00	4.00	4.00
Molasses	2.00	2.00	2.00	2.00	2.00
Marble chips	1.10	1.00	1.00	0.90	0.90
Di-calcium phosphate	0.87	0.88	0.91	0.94	0.94
L-Lysine	0.17	0.17	0.14	0.10	0.10
DL-Methionine	0.10	0.09	0.08	0.07	0.06
Oil	0.00	0.00	0.00	0.00	0.54
Salt	0.11	0.11	0.11	0.11	0.11
Sodium bicarbonate	0.08	0.08	0.08	0.08	0.08
Premix	0.50	0.50	0.50	0.50	0.50

*A: 5% Canola meal (CM); B: 10% CM; C: 15% CM; D: 20% CM; E: 25% CM.

Table 2: Composition (%) of broiler finisher diets with different levels of canola meal

Ingredients	Diets*				
	A	B	C	D	E
Corn	24.02	23.99	23.97	24.02	24.00
Rice broken	14.01	14.20	14.88	18.12	17.50
Wheat	15.01	14.99	14.98	15.01	15.00
Rice polishing	12.01	12.00	11.19	6.21	5.00
Wheat bran	1.70	0.00	0.00	0.00	0.00
Corn gluten meal 60%	0.70	0.70	0.70	0.30	0.20
Corn gluten meal 30%	0.50	0.50	0.50	0.50	0.00
Canola meal	5.00	10.00	14.98	20.02	24.99
Sunflower meal	3.00	2.70	0.00	0.00	0.00
Guar meal	3.00	3.00	2.90	0.00	0.00
Soybean meal	13.01	9.90	7.99	8.01	5.00
Fish meal	3.00	3.00	3.00	3.00	3.00
Molasses	2.00	2.00	2.00	2.00	2.00
Marble chips	0.90	0.90	0.80	0.70	0.70
Di-calcium phosphate	0.80	0.81	0.83	0.85	0.84
Bone meal	0.50	0.50	0.50	0.50	0.50
L-Lysine	0.07	0.07	0.06	0.02	0.02
DL-Methionine	0.09	0.08	0.08	0.07	0.06
Oil	0.00	0.00	0.00	0.00	0.48
Salt	0.11	0.11	0.11	0.11	0.11
Sodium bicarbonate	0.06	0.06	0.05	0.06	0.08
Premix	0.50	0.50	0.50	0.50	0.50

*A: 5% Canola meal (CM); B: 10% CM; C: 15% CM; D: 20% CM; E: 25% CM.

(Snedecor and Cochran, 1980) under completely randomized design. Least significant difference test was applied for multiple mean comparisons.

RESULTS AND DISCUSSION

During the starting and finishing periods of growth, the chickens fed diet containing 25% canola meal gained maximum weight compared to other diets (Table 4). However, the difference was non significant among the treatments. These results are supported by the findings of Lee *et al*. (1991) and Idrees (1998), who reported that canola meal can be used from 15 to 25% without any adverse effect on growth of broiler chickens. However, Arena and Penz (1990) and Franzon *et al*. (1998) reported that weight gain in broiler chickens was reduced with higher concentrations of canola meal (30 to 40%) due to effects of growth inhibiting factor i.e. glucosinolates (>30 µmol/g). In the present study, canola meal contained <30 µmol/glucosinolate due to its better processing techniques.

During the first four weeks of growth, the broiler chickens consumed less ($P<0.01$) diet containing 25% canola meal than other diets (Table 4), however, during finishing period of growth, the difference was not significant ($P>0.05$) among treatments. Nassar and Arscot (1986) and Franzon *et al*. (1998) reported that broilers chicken consumed less diet from 0 to 21 days and from 36 to 40 days when higher level (up to 40%) of canola meal was used in the diets. However, no reduction in feed intake was observed when canola meal was used upto 15% (Leeson *et al*., 1987). The exact reason of decrease in feed intake is not known but it may be due to its high fibre content.

Broiler chickens fed diet containing 25% canola meal showed better ($P<0.01$) feed conversion ratio (FCR) values compared to other diets during starting phase of growth (Table 4). However, the difference was non significant ($P>0.05$) among the diets during finishing phase. The broilers fed diet with 5% canola meal had lowest ($P<0.01$) FCR compared to other diets during starting phase of growth (Table 4). However, this difference was non significant ($P>0.05$) during the 5th week of trial. Franzon *et al*. (1998) reported that layer chickens fed diet containing canola meal had better FCR values with increasing canola meal level (20 to 40%) in diets. It might be due to better protein quality (increased availability of proteins due to 85% KOH solubility) of canola meal that was superior to other vegetable meals.

Dressing percentage and relative weights of liver in chickens of five groups are presented in Table 5. Apparently better dressing percentage and relative weight of liver was found in chickens fed diet supplemented with 25% canola meal compared to those

Table 3: Percent nutrient composition and aflatoxin (ppb) of broiler diets with different levels of canola meal

Ingredients	Diets*				
	A	B	C	D	E
Broiler starter					
Dry matter	90.35	90.45	89.85	90.15	90.00
Crude protein	20.02	20.56	19.91	20.34	20.56
Crude fat	4.00	4.33	3.66	3.00	3.66
Crude fibre	5.50	5.50	5.50	4.00	4.50
Nitrogen free extract	64.18	63.31	64.53	66.86	64.68
Ash	6.30	6.30	6.40	5.80	6.60
Salt (inorganic)	0.33	0.28	0.30	0.30	0.30
Calcium	1.10	1.05	0.90	0.90	0.95
Phosphorus (total).	0.63	0.64	0.59	0.61	0.68
Aflatoxin (B_1+B_2)	14.00	14.00	14.00	14.00	14.00
Broiler finisher					
Dry matter	88.60	88.75	87.15	87.60	87.40
Crude protein	18.81	19.25	19.25	18.81	19.47
Crude fat	4.66	4.66	4.66	3.33	4.33
Crude fiber	5.00	5.00	5.00	4.50	5.00
Nitrogen free extract	65.59	69.06	66.94	64.41	67.17
Ash	5.66	6.00	5.66	5.66	5.66
Salt (inorganic)	0.27	0.24	0.27	0.27	0.30
Calcium	0.90	1.00	1.00	0.95	0.90
Phosphorus (total)	0.74	0.75	0.67	0.67	0.70
Aflatoxin (B_1+B_2)	25.00	25.00	25.00	25.00	25.00

*A: 5% Canola meal (CM); B: 10% CM; C: 15% CM; D: 20% CM; E: 25% CM.

Table 4: Performance of broilers fed diets containing different levels of canola meal

Diets*	Weight gain (g)		Feed intake (g)		FCR	
	0-28 d	29-35 d	0-28 d	29-35 d	0-28 d	29-35 d
A	1288.27	426.33	2258.63^{d}	913.64	1.72^{c}	2.13
B	1308.74	431.29	2244.66^{cd}	891.56	1.71^{c}	2.13
C	1310.44	441.44	2179.39^{bc}	895.16	1.68^{bc}	2.01
D	1313.86	446.44	2168.31^{b}	894.92	1.67^{b}	1.99
E	1314.57	475.43	2086.19^{a}	878.43	1.59^{a}	1.91

*A: 5% Canola meal (CM); B: 10% CM; C: 15% CM; D: 20% CM; E: 25% CM.
Means with different letters within a column differ significantly ($P \leq 0.01$).

fed diets containing 5, 10, 15 and 20% canola meal (Table 5), however, the difference were non significant ($P>0.05$). These findings are supported by those of Kinal and Kroliczck (1983), who reported that dressing %age was better at higher level of canola meal (30%) in a broiler diet due to its high digestibility value than rapeseed meal.

Total chicken mortality during starter phase was 1, 3, 4, 5 and 6%, while during finisher phase it was 0, 1, 2, 2 and 3% for diets A, B, C, D and E, respectively. Comparatively higher mortality was observed in chicken fed diet with 25% canola meal compared to other diets. This was consistent with the observations of Campbell and Slominski (1999) with 25% canola meal. Mortalities were recorded due to ascites because of rapid growth, high feed efficiency and large pectoral muscle mass, all require high oxygen level. Modern chicken has a small lung volume:body weight ratio, causing an inability of the respiratory system to respond to the broilers elevated oxygen needs, which can lead to hypoxia and respiratory acidosis (Kiiskimen, 1985). Acidosis affects cellular membrane integrity and reduces free radical elimination, transude leakage of blood vessels that leads to accumulation in the abdominal cavity; hence the ascites develops (Proudfoot and Hulan, 1987).

Finally, the economics of high level (25%) of canola

Table 5: Percent dressed carcass weights and relative weights of liver of broiler chickens fed canola meals

Parameters	Diets*				
	A	B	C	D	E
Dressing percentage	58.15	58.47	59.44	59.78	62.11
Relative weights of liver	18.60	18.86	21.05	21.85	22.15

*A: 5% Canola meal (CM); B: 10% CM; C: 15% CM; D: 20% CM; E: 25% CM.

meal diet was more encouraging, as it generated more profit than that of low level of canola meal diets. The results revealed that per bird total return on sale was Rs. 76.29, 76.38 , 76.78, 77.00 and 78.62 at total expenditure of Rs. 61.39, 60.99, 60.19, 60.12 and 59.29 for groups A, B, C, D and E, respectively (Table 6). The net per bird income was Rs. 14.90, 15.39, 16.59, 16.88 and 19.33 for groups A, B, C, D and E, respectively. Economic data clearly indicated that high level of canola meal (25%) was more feasible and economical to obtain maximum profitability from broiler production. Low prices of canola meal and better feed efficiency with increasing level of canola meal are two major factors which resulted in decreased cost of production.

The findings of this experiment suggested that canola meal (with 85% KOH solubility) can be incorporated upto 25% in broiler starter and finisher diets without any adverse effect on production parameters. For optimizing the profits from feeding of canola meal, it may be used to higher level in the diets of commercial broiler chicks.

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Table 6: Economic analysis of broiler fed on experimental diets (0-5 weeks)

Parameters	Diets*				
	A	B	C	D	E
Chick cost (Rs.)	12.00	12.00	12.00	12.00	12.00
Feed intake (g/bird)	3172.27	3136.22	3063.46	3057.82	2981.11
Cost of feed consumed (Rs./bird)	34.89	34.49	33.69	33.62	32.79
Others (vaccine, medicine, elec.etc.)	14.50	14.50	14.50	14.50	14.50
Total cost (Rs.)	61.39	60.99	60.19	60.12	59.29
Average live weight after 35 days (g)	1734.70	1736.76	1745.15	1750.18	1787.94
Return on sale @ Rs.44 per Kg (Rs.)	76.29	76.38	76.78	77.00	78.62
Per bird net profit (Rs.)	14.9	15.39	16.59	16.88	19.33

*A: 5%CM, B: 10%CM, C: 15% CM, D: 20%CM and E: 25%CM
Cost of diets =Rs.11.0 /Kg

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