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Influence of Feed Supplementation with *Cannabis Sativa* on Quality of Broilers Carcass

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ABSTRACT

A project was planned to study the effect of feeding powdered seeds of *Cannabis sativa* on the carcass quality of broiler chicks. A total of 160 day-old broiler chicks of equal weight were randomly divided into four equal groups A, B, C and D. Each group was further divided into four replicates with 10 chicks in each replicate. Dried crushed *Cannabis sativa* seeds were added to the feed of groups B, C and D at the rate of 5, 10 and 20% of offered feed respectively, while group A served as a control. The studied parameters were body weight, feed intake, feed conversion ratio (FCR), dressing percentage, mortality and economics. After an experimental period of 42 days, the data were analyzed statistically. It was revealed from the results that body weight gain was significantly higher ($P<0.05$), while feed intake was significantly lower ($P<0.05$), in group D compared to the control. FCR was significantly better in birds of group D compared to controls. Differences in dressing percentage and mortality were non significant between the treated and control groups. Return per chick (in rupees) was significantly higher in group D compared to groups A and B ($P<0.05$). It was concluded from these results that seeds of *Cannabis sativa* have remarkable impact on growth of broiler chicks and can help in alleviating feed expenditure incurred on raising broiler chicks.

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INTRODUCTION

Hempseed (*Cannabis sativa L.*) have been used as an important source of food, fiber and medicine for thousands of years (Pringle, 1997; Padua *et al*., 1999). Whole hempseeds contain approximately 25% proteins, 31% fats, 34% carbohydrates and 75-80% polyunsaturated fatty acids, in addition to vitamins and minerals (Darshan and Rudolph, 2000; Leizer *et al.*, 2000; Callaway, 2004). The gross energy (GE) content of an oil variety of hempseed has been estimated as 22.0 MJ/Kg and hempseed proteins are regarded as easily digested (Callaway, 2004). The oil of hempseed is comparable to black currant oil which improves immunity (Barre, 2001). Hayatghaibi and Karimi (2007) reported that in Pakistan, Iran and Turkey, baked hempseeds are sold by street vendors and are very popular among children as nuts. In Iran, hempseeds are fed to male birds during breeding season to increase their vitality and seed-eating migratory birds are especially attracted to hempseed fields at harvest time (Hayatghaibi and Karimi, 2007). In North America, hempseeds have been used and are imported as bird feed (Pringle, 1997; Callaway, 2004). *Cannabis sativa* contains compounds such as phytocannabinoids and plant sterols. Tetrahydrocannabinol (THC) is potent lipophilic antioxidants which stimulates appetite (Hampson *et al.*, 2000; Koch, 2001).

Feed is a major component affecting net return from the poultry business, since 60-70% of input in term of money is spent on poultry feed (Khan *et al*., 2009). To maximize net return and to minimize feed cost, different feed additives are mixed with poultry feed in order to achieve desirable results. *Cannabis sativa* is grown naturally in the tribal regions of North West Frontier Province (NWFP) of Pakistan and in Afghanistan due to the favorable environmental conditions and soil characteristics. In most of these regions, hempseeds are available in markets and are very popular among people as bird feed due to high quality feed contents and low cost compared to other grains. In developing countries feed cost is the major factor in rising poultry meat and eggs. Therefore, this study was undertaken to evaluate the effect of *Cannabis sativa* on the growth performance and economics of rearing broiler chicks.

MATERIALS AND METHODS

A total of 160 day-old commercial broiler chicks were obtained from the local market and were randomly divided into four equal groups A, B, C and D. Each group was further divided into four replicates having 10 chicks per replicate. The birds were raised on conventional deep litter system, with open sided house. All the pens were located in one house to have identical environment. Chicks were reared in cages in an open sided house, provided with feeders, drinkers and electric bulbs, while wood shavings were used as bedding material. Strict sanitation practices were applied throughout the experiment.

The seeds of *Cannabis sativa* were purchased from the local market. After drying, the seeds were ground with the help of electric grinding machine and were added to commercial broiler starter, grower and finisher rations @ 0, 5, 10 and 20% for groups A, B, C and D, respectively. The ingredients and composition of basal diet is given in Table 1. Experiment lasted for 42 days. Average temperature at day time was 30°C and 25°C at night. Feed intake, weight gain and feed conversion ratio (FCR) were calculated each week. Mortality was also recorded. At the end of experiment, 8 birds were selected randomly from each group and were slaughtered. Skin and feathers were removed and dressing percentage was calculated for each group.

Cost per chick (in rupees) was calculated by adding expenditure of total feed consumed by each bird, vaccination, medication, labor, light, gas and other miscellaneous charges. The carcasses of all birds were sold and net return per chick was calculated for each group.

The data were statistically analyzed through analysis of variance (ANOVA), using completely randomized design. Means were compared by least significance differences (LSD), as suggested by Steel and Torrie (1980). To establish association between levels of *Cannabis sativa* and its effects on body weight and feed intake, the regression model of Wonnacott and Wonnacott (1985) was used. The statistical package (SAS, 1989) was used to perform the above analysis on a computer.

RESULTS AND DISCUSSION

Data on body weight, feed intake, feed conversion ratio, dressing percentage and mortality for the chicks four experimental groups A, B, C and D fed diets having 0, 5, 10 and 20% *Cannabis sativa* are given in Table 2. The mean body weight gain at the end of the experiment was significantly higher ($P<0.05$) in group D as compared to the control. Body weight of chicks of group B was lower, while that of group C was higher, compared to control ($P<0.05$). Level of *Cannabis sativa* was found to be positively associated with weight gain ($b=14.49 \pm 4.19$; Table 3) as revealed by Wonnacott and Wonnacott (1985) model. These findings suggested that 1% increase in the level of *Cannabis sativa* resulted in an increase of 14.49 gm in weight gain. As evident from the observations recorded in Table 2, addition of *Cannabis sativa* @ 20% resulted in maximum weight gain (2087.2 ± 10.25 gm).

The feed consumption data revealed significant difference among the groups. Feed consumption was significantly higher (5014.4 ± 6.3 gm) in group A as compared to other groups. However, the higher feed consumption in the control group did not result into proportionate increase in the body weight gain, therefore, resulted in lower efficiency of feed utilization. Feed consumption was lowest in group D. However, the significant factor to be considered here is the fact that in spite of this lower feed consumption by chicks of group D, higher weight gain was obtained, thus resulting in most efficient feed conversion ratio. Level of *Cannabis sativa* was found to be significantly and negatively associated with feed consumption ($b=-39.21 \pm 10.62$; Table 4) as calculated by Wonnacott and Wonnacott (1985) model. These findings suggested that 1% increase in the level of *Cannabis sativa* resulted in a decrease of 39.21 gm feed consumption. The feed efficiency data when subjected to statistical analysis showed significant difference ($P<0.05$) among the groups. FCR was significantly better in group D as compared to the control. Highest dressing percentage was observed in group D as compared to other groups. However, when the data were subjected to analysis of variance, non significant differences ($P>0.05$) were observed among the groups. Similarly, mortality did not differ significantly among the groups (Table 2).

The average cost of rearing each chick was highest ($P>0.05$) in control group (Table 5). Significantly higher ($P<0.05$) return of Rs.129.4 per chick was recorded in group D compared to groups A and B. As evident from these findings, there was an increase of Rs.14 per chick, amounting to a significant amount of Rs.14000 per 1000 boilers in group D as compared to the control.

The results of 20% added *Cannabis sativa* to feed show positive effect on the growth, feed intake and feed efficiency (FCR) in birds of group D. Net return per chick was also high in this group, indicating overall a positive effect of this treatment. Our results are similar to Wheeler (1994), Dobretsberger *et al.* (1996) and Lisson and Mendham (2000), who registered positive results of *Cannabis sativa* added to feed on broiler weight and feed conversion ratio. Tetrahydrocannabinol (THC) is a novel compound in the seeds of *C. sativa* which stimulates appetites (Adams and Martin, 1996; Koch, 2001), whereas the cannabinoid receptor antagonist SR 141716 reduces food intake (Arnone *et al.*, 1997; Colombo *et al.*, 1998; Simiand *et al.*, 1998). In our experiment, the feed intake decreased with increasing level of *Cannabis sativa* and was minimum at 20% supplementation which may be attributed to cannabinoid receptor. The oil of *Cannabis sativa* contains 75-80% polyunsaturated fatty acids and is the most perfectly balanced oil due to the presence of omega 3 and omega 6 fatty acids which are essential for good health and growth (Erasmus, 1999; Simopoulos, 2002). Addition of oils in broiler diets is known to significantly improve feed utilization, and it further tends to improve body weight gain (Sell and Hodgson, 1962).

Table 1: Ingredients and composition of basal diet (%)

Ingredients (g/kg of diet)	Starter	Grower	Finisher
Maize, yellow	354.0	329.0	250.0
Soybean meal (480 g CP/Kg)	275.0	205.0	170.0
Sunflower meal 350 g CP/Kg)	110.0	151.0	110.5
Wheat	99.0	130.5	331.0
Wheat bran	-	37.0	-
Meat-bone meal	65.0	55.5	49.5
Vegetable oil	73.9	85.5	73.5
Limestone	13.5	-	-
Mineral-vitamins premix[1]	3.5	3.1	3.5
Sodium chloride	3.1	2.5	2.5
L-lysine	0.4	-	0.1
DL-Methionine	1.6	0.1	1.7
Calculated chemical composition (per Kg of diet)[2]			
ME (MJ)	13.2	13.4	13.4
Crude Protein (g)	231.2	212.0	189.8
Calcium (g)	15.0	9.0	8.0
Available phosphorus (g)	5.0	4.7	3.9
Lysine (g)	12.0	10.0	8.5
Methionine (g)	5.6	4.0	5.2
Methionine + cystine (g)	9.3	7.6	8.4
Sodium chloride (g)	3.4	2.9	2.9

[1]Provides per kg of diet: Mn 80 mg; Zn 60 mg; Fe 60 mg; Cu 5 mg; Co 0.2 mg; I 1 mg; Se 0.15 mg; choline chloride 200 mg; vitamin A 12 000 IU; vitamin D3 2 400 IU; vitamin E 50 mg; vitamin K3 4 mg; vitamin B1 3 mg; vitamin B2 6 mg; niacin 25 mg; calcium-d- pantothenate 10 mg; vitamin B6 5 mg; vitamin B12 0.03 mg; d-biotin 0.05 mg; folic acid 1 mg
[2]calculated from NRC values (1994)

Table 2: Mean (±SE) values of body weight, feed intake, feed conversion ratio, dressing percentage and mortality in response to different levels of *Cannabis sativa*

Parameters	Groups			
	A (control)	B (5%)	C (10%)	D (20%)
Body weight (g)	1861.4 ± 32.2^{c}	1717.2 ± 12.02^{d}	1933.1 ± 9.02^{b}	2087.2 ± 10.25^{a}
Feed intake (g)	5014.4 ± 6.3^{a}	4506.9 ± 91.9^{b}	4327.7 ± 71.9^{c}	4070.2 ± 20.2^{d}
Feed conversion ratio	2.60 ± 0.15^{a}	2.5 ± 0.38^{b}	2.3 ± 1.02^{b}	1.95 ± 0.032^{c}
Dressing percentage (%)	58.30 ± 3.04^{a}	61.3 ± 2.59^{a}	62.4 ± 1.47^{a}	63.3 ± 3.04^{a}
Mortality (%)	7.5^{a}	7.0^{a}	5.0^{a}	5.0^{a}

Values with different superscript in a row differ significantly (P<0.05).

Table 3: Prediction of weight gain in broiler chicks from percent level of *C. sativa*

Estimates	b_0	b_1
Parameter estimate	1772.08	14.49
± SE	48.08	4.19
t -value	36.89^{**}	3.45^{**}

R2 (Adjusted) = 42.13% ** = Significant (P<0.05). Response variable = Weight gain in grams; Regressor = % *Cannabis sativa* in feed

Table 4: Prediction of feed intake in broiler chicks from percent level of *C. sativa*

Estimates	b_0	b_1
Parameter estimate	4822.9	-39.21
± SE	121.62	10.62
t -value	39.65^{**}	-3.69+**

R2 (Adjusted) = 45.53%; ** = Significant (P<0.05). Response variable = Reduction in feed intake in grams; Regressors = % *Cannabis sativa* in feed

According to Al-Kassie (2009), essential oil derived from thyme and cinnamon can be considered as growth promoters in broilers, while Khadija *et al*. (2009) recorded adverse effects of dietary monosodium glutamate on broiler performance.

Table 5: Economics of broiler chicks fed different levels of *Cannabis sativa*

Parameters	Groups			
	A (Control)	B (5%)	C (10%)	D (20%)
Cost/chick (Rs)*	97.7	98.9	101.7	103.8
Return/chick (Rs)*	115.4^{b}	116.5^{b}	119.9^{ab}	129.4^{a}

Values with different superscript in a row differ significantly (P<0.05). *1 US$= 80 Rs.

The positive effect of broiler performance in this experiment indicates the nutritive effect of *Cannabis sativa* seeds. This might be due to rich nutrient content of poly saturated and unsaturated fatty acids, superior quality amino acids and other components like vitamins and minerals. A direct comparison of amino acids profile showed that hempseed protein is comparable to those from egg white and soybeans in quality (Callaway, 2004). Sakakibara *et al.* (1991) concluded from their studies that *Cannabis sativa* have purgative effect due to the presence

of canabisin A. It has been regarded as alternative feed source for poultry in India (Sapcota, 1992). Hampson *et al*. (2000) reported superior antioxidant activity of cannabidiol than alph-tocopherol and ascorbate. The fact that trypsin inhibitory substances are absent in hemp protein (Odani and Odani, 1998) partially explains it a superior protein to soybeans. Due to efficient feed utilization, it is suggested that feed cost/chick has decreased and net return/chick has increased.

Cannabis sativa has been shown to alleviate stress (Wheeler, 1994), improve immunity (Zhu *et al.*, 1997), suppress tumerous cells (Guzman, 2003), having antimicrobial (Zhu *et al.*, 1997; Novak *et al.*, 2001) and antiviral activities (Morhan, 1997). Moreover, it has also been reported for anti-inflammatory, antipyretic, antiparasitic and insecticidal effects (Piao, 1990; Nok *et al.*, 1994; Bishnupada *et al.*, 1997). Combinations of these beneficial effects might have resulted in better performance of chicks given feed supplemented with 20% *Cannabis sativa.*

In conclusion, the seed powder of *Cannabis sativa* at added to the feed at the rate of 20% has positive effect on carcass quality of broiler chicks. It will also decrease the market age and mortality rate which subsequently decrease the productive cost.

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