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EVALUATION OF PRODUCTIVE PERFORMANCE OF BROILER IN RESPONSE TO KOROCH (*Pongamia pinnata*) CAKE FEEDING

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ABSTRACT

The study was conducted for a period of 28 days to investigate the response of broiler to the inclusion of de-oiled koroch (*Pongamia Pinnata)* seed cake in the diet of broiler. A total of 192 day-old broiler chicks were individually weighed and randomly allocated to 4 dietary treatment groups having 4 replications of 12 chicks each, in a completely randomized design. Broilers under treatment 1 received a basal diet containing no koroch seed cake, considered as control; in treatment 2, 3 and 4, broilers were fed on basal diet containing 2%, 4% and 6% koroch seed cake, respectively. All productive performances (live weight, live weight gain, feed consumption and feed efficiency) of broiler fed on koroch seed cake were significantly ($P<0.01$) depressed compared to the control. The degree of depression was increased with the increasing level of koroch seed cake in the diet at all ages of broiler. The meat yield parameters showed a non-significant ($P>0.05$) effect except for the percentage of dressing yield, breast, liver and gizzard weight for the broilers in all treatment groups. Broilers fed on diet containing 6% koroch seed cake yielded the lowest dressed weight in the treatment groups. Inclusion of 2% koroch seed cake resulted in higher breast meat yield compared to any other level of koroch cake inclusion in the diet ($P<0.01$). However, liver and gizzard weight were increased significantly ($P<0.05$) for incorporation of de-oiled koroch seed cake in the diet at all levels (2%, 4% or 6%). On the basis of these results it is concluded that feeding de-oiled koroch cake had no positive effect on growth response and meat yield characteristics of broiler. Therefore, it is suggested that the koroch seed cake may contain anti-nutritional factor(s), which seemed to be associated with growth depression in broilers. Further research is warranted to alleviate the potential toxic effect of koroch seed cake on broiler performances.

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INTRODUCTION

Increasing feed cost and non-availability of major grains (maize, wheat or soybean) are the root causes of increasing the cost of poultry production. There is a constant competition among human, livestock and poultry for grains. Cost and availability of grains fluctuate due to natural calamities. Dependency on costly imported grains and their use increase feed cost that hardly permits profitable poultry rearing. Therefore, it was suggested to formulate cheaper diet using unconventional feeds.

Karanj (*Pongamia pinnata)* is one of the nitrogen fixing trees, which produces huge seeds with high nutritional value. In Bangladesh, it is popularly known as Koroch. It is available in the highway, roads, haor and canal of Sylhet region, Sundarban mangrove forest region of Bangladesh. Huge amount of Koroch seeds in Bangladesh was not tested to introduce as unconventional poultry feed, despite its potential chemical composition. It has been reported that air dried kernels had 19.0% moisture, 27.5% fatty oil, 17.4% protein, 6.6% starch, 7.3% crude fiber, and 2.4% ash (James, 1983). The oil cake, when extracted from the seeds, is used as a feed to be cheaper than soybean meal (James, 1983). However, the koroch seed has been shown to contain tannin (23.2g/kg DM) and trypsin inhibitor (62g/kg protein) (Natanam *et al.*, 1989a). The oil from the koroch seed has a high content of triglycerides and has disagreeable taste and odor due to the presence of bitter flavonoid constituents, pongamin and karanjin (Allen and Allen, 1981). Therefore, the oil extracted cake after processing through oil extraction technique might be feasible to formulate broiler diet. In order for the elucidation of the feeding value of de-oiled koroch seed cake in broiler, this study investigated the effect of different levels of oil extracted koroch cake on productive performance and meat yield characteristics of broilers.

MATERIALS AND METHODS

The study was conducted at Bangladesh Agricultural University Poultry Farm, Mymensingh, Bangladesh. The experimental day-old broilers were purchased from “Nourish Poultry and Hatchery Ltd. Shreepur, Gazipur, Bangladesh. The chicks were reared up to 28 days of age. Koroch seeds were collected from Sunamgonj Hoar area. The oil from seeds was expelled locally from an oil extraction mill. Then the remaining cake was dried and proximate analysis was done for Koroch cake.The proximate composition of the feed ingredients was analyzed as per AOAC (1995) and is furnished in Table 1.

The experiment was carried out with a total number of 192 broilers. They were fed on diet containing either 0%, 2%, 4% or 6% de-oiled Koroch cake. These experimental diets were considered as 4 different treatments. Each treatment was consisting of 4 replications having 12 birds per replication. Broilers in each treatment group were fed *ad libitum* on starter (Table 2) and grower diet (Table 3) for 0-21 days and 22-28 days period, respectively. The recommended medications and vaccines (Table 4) were administered to ensure good health status of the experimental birds.

Birds were weighed at the first day of experiment (initial body weight) and weekly basis for all birds from each replication. Average body weight gain of the broiler in each replication was calculated by deducting initial body weight from the final body weight. The amount of feed consumed by the birds in each replication of each treatment group were calculated for every week by deducting the amount of feed left over from the amount supplied for a particular week. Feed conversion ratio (FCR) was calculated as the unit of feed consumed per unit of body weight gain.

At the end of feeding trial, one broiler having near to pen average weight was taken from each pen for recording meat yield parameters. Broilers were slaughtered and allowed to bleed for 2 minutes and immersed in hot water (semi-scalding; 51-55°C) for 120 seconds in order to loose feathers followed by removal of feathers by hand pinning. Then head, shank, viscera, giblet (heart, liver and gizzard) and abdominal fat were removed for determination of meat yield parameters. Dressed broilers were cut into different parts such as breast, thigh, drumstick and wing. Finally, every cut up parts were weighed and recorded separately for each broiler of all replications.

Table 1. Proximate composition of Koroch seed and cake

	Moisture (%)	CP (%)	Ash (%)	CF (%)	EE (%)
Seed	9.04	22.43	2.41	5.57	26.17
Cake	8.89	24.27	3.12	2.37	14.61

Table 2. Ingredients and nutrient composition (%) of starter diet (0-21 days)

Ingredients	Different level of oil extracted Koroch seed cake			
	0%	2%	4%	6%
Maize	61.00	59.90	59.00	58.00
Rice Polish	2.00	2.00	1.00	1.00
Soybean meal	24.9	24.0	23.65	22.4
Protein Concentrate.	9.00	9.00	9.00	9.00
Koroch cake	0.00	2.00	4.00	6.00
Vegetable oil	0.00	0.00	0.25	0.50
Dicalcium phosphate	2.00	2.00	2.00	2.00
Vit.-min. premix	0.25	0.25	0.25	0.25
DL-Methionine	0.20	0.20	0.20	0.20
L-lysine	0.15	0.15	0.15	0.15
Common Salt	0.50	0.50	0.50	0.50
Nutrient composition				
ME Kcal/kg	2971	2952	2945	2941
Crude protein (%)	22.38	22.37	22.50	22.35
Crude fiber (%)	3.82	3.78	3.68	3.62
Calcium (%)	1.28	1.28	1.28	1.27
AV. Phosphorus (%)	0.71	0.71	0.70	0.70
Lysine (%)	1.30	1.27	1.25	1.22
Methionine (%)	0.55	0.54	0.54	0.53

Table 3. Ingredients and nutrient composition (%) of grower diet (22-28 days)

Ingredients	Different level of oil extracted Koroch seed cake			
	0%	2%	4%	6%
Maize	65.05	63.44	61.62	60.23
Rice Polish	2.00	2.00	2.00	2.00
Soybean meal	20.69	19.91	19.18	18.35
Protein Concentrate.	7.50	7.50	7.50	7.50
Koroch cake	0.00	2.00	4.00	6.00
Vegetable oil	1.66	2.05	2.50	2.82
Dicalcium phosphate	2.00	2.00	2.00	2.00
Vit.-min. premix	0.25	0.25	0.25	0.25
DL-Methionine	0.20	0.20	0.20	0.20
L-lysine	0.15	0.15	0.15	0.15
Common Salt	0.50	0.50	0.50	0.50
Nutrient composition				
ME Kcal/kg	3100	3100	3100	3100
Crude protein (%)	20.0	20.0	20.0	20.0
Crude fiber (%)	3.61	3.56	3.51	3.47
Calcium (%)	1.20	1.19	1.19	1.19
AV. Phosphorus (%)	0.68	0.67	0.67	0.66
Lysine (%)	1.14	1.12	1.09	1.06

Methionine (%)	0.52	0.51	0.50	0.49

Statistical analysis

All recorded and calculated data were statistically analyzed using analysis of variance (ANOVA) technique by a computer using SAS statistical package program in accordance with the principles of Completely Randomized Design (SAS, 2009). Duncan's multiple range test (DMRT) was done to compare variations among diets where ANOVA showed significant differences.

Table 4. Vaccination schedule for the experimental broilers

Age of broilers (day)	Name of Vaccine	Trade Name*	Dose	Route
4	IB+ND	MA5+Clone30	One drop	Ocular
10	IBD	D-78	One drop	Ocular
21	IBD	D-78	One drop	Ocular

IB, Infectious Bronchitis; ND, Newcastle Disease; IBD, Infectious Bursal Disease *Intervet International, B.V. BOXMEER, The Netherlands.

RESULTS AND DISCUSSION

Growth performance

Overall performances of broiler chicks as affected by inclusion of different dietary levels of koroch seed cake are shown in Table 6. Final body weight, body weight gain, feed consumption and FCR were significantly (P<0.01) influenced by dietary treatments. All performances of broilers fed on koroch seed cake at different levels were significantly (P<0.01) depressed compared to the control. The degree of depression was increased with the increasing inclusion level of koroch seed cake in the diet of broiler. The weekly changing pattern of broiler performances was shown in Table 5.

Table 5. The weekly growth performance of broilers fed on oil extracted Koroch seed cake

Trait	Age (week)	Different level of oil extracted Koroch seed cake				Significant Level
		0%	2%	4%	6%	
Body weight (g)	Day-old	40.11±0.19	40.08±0.07	40.11±0.37	40.04±0.39	NS
	1st	150.42±4.22^{a}	132.92±4.22^{a}	120.58±6.85^{b}	109.50±6.32^{c}	**
	2nd	379.54±22.46^{a}	317.21±7.78^{b}	276.88±21.58^{c}	242.58±20.11^{d}	**
	3rd	704.38±33.30^{a}	595.73±14.92^{b}	476.25±17.87^{c}	421.04±35.97^{d}	**
	4th	1087.9±25.15^{a}	940.54±25.57^{b}	720.05±26.24^{c}	635.63±67.57^{d}	**
Body weight gain (g)	1st	110.31±4.36^{a}	92.83±5.34^{b}	80.48±3.57^{c}	69.46±6.24^{d}	**
	2nd	229.12±20.17^{a}	184.29±8.50^{b}	156.29±15.71^{c}	133.08±14.40^{c}	**
	3rd	324.83±23.95^{a}	278.52±18.41^{b}	199.38±23.83^{c}	178.46±19.98^{c}	**
	4th	383.59±12.65^{a}	344.81±11.43^{b}	243.80±11.27^{c}	214.59±33.07^{c}	**
Feed intake (g)	1st	101.82±1.40^{a}	100.13±1.39^{ab}	95.21±3.81^{bc}	93.28±4.85^{c}	**
	2nd	266.15±10.58^{a}	253.75±4.39^{ab}	238.13±15.33^{bc}	226.96±14.74^{c}	**
	3rd	494.27±20.44^{a}	456.87±16.34^{b}	402.50±23.23^{c}	390.63±32.82^{c}	**
	4th	774.68±13.54^{a}	734.37±13.29^{a}	610.21±14.30^{b}	570.33±46.95^{b}	**
Feed conversion ratio	1st	0.93±0.05a	1.08±0.06^{b}	1.19±0.06^{c}	1.35±0.06^{d}	**
	2nd	1.17±0.15^{a}	1.38±0.05^{b}	1.53±0.07^{b}	1.71±0.11^{c}	**
	3rd	1.53±0.05^{a}	1.64±0.06^{a}	2.03±0.14^{b}	2.20±0.08^{c}	**
	4th	2.02±0.09^{a}	2.13±0.10^{b}	2.51±0.13^{c}	2.69±0.26^{c}	**

$^{a-d}$Mean±SD values with different superscripts within same row differ significantly; NS=Non-significant; **=significant (p<0.01)

The depression in body weight and feed intake and poor weight gain in the present study on koroch seed cake incorporated diet was in agreement with the findings of Mandal and Banerjee (1974) and Panda *et al.* (2008). Panda *et al.* (2008) observed that increasing the inclusion of solvent extracted karanj cake significantly decreased the body weight gain and feed intake, and resulted in poor feed efficiency. On the other hand, Mandal and Banerjee (1979) recommended that de-oiled karanj cake (EE<0.05%) could safely be included at 5% level in the diet of broiler chicken. Similarly, Dhara *et al.* (1997) reported that de-oiled karanj cake could be included in the diet to a maximum level of 4.45%. The adversed effect of high level of koroch seed cake inclusion on growth and feed intake might be due to the residual oil content of the cake. Although the oil was extracted by normal milling procedure, the oil content of cake was 14.61% which was attributed to the presence of toxic factors left back in the cake. Allen and Allen (1981) stated that the oil of koroch seed has a high content of triglycerides, and has disagreeable taste and odor for bitter flavonoid constituents, pongamin and karanjin.

Table 6. Performances of broilers fed on oil extracted Koroch *(Pongamia Pinnata)* seed cake during the experimental period

Parameter	Different level of oil extracted Koroch seed cake				Signi. level
	0%	2%	4%	6%	
Initial weight (g)	40.11±0.19	40.08±0.07	40.11±0.37	40.04±0.39	NS
Final weight (g)	1087.96±25.15^{a}	940.54±25.57^{b}	720.05±26.2^{c}	635.63±67.57^{d}	**
Body weight gain (g)	1047.85±25.29^{a}	900.46±25.53^{b}	679.95±26.5^{c}	595.58±67.71^{d}	**
Feed Intake (g)	1636.92±16.83^{a}	1545.13±4.82^{b}	1346.04±7.7^{c}	1281.2±70.88^{d}	**
Feed conversion ratio (FCR)	1.56±0.02^{a}	1.72±0.05^{b}	1.98±0.03^{c}	2.20±0.09^{d}	**

$^{a-d}$Mean±SD values with different superscripts within same row differ significantly; Signi. = Significant; NS=Non-significant; **=significant (p<0.01)

Dietary incorporation of koroch seed cake also depressed the feed efficiency in the present study. Increasing the inclusion level from 2% to 6%, resulted in lowered feed efficiency, which is in line with the findings of Dhara *et al.* (1997). They observed poor feed efficiency by dietary incorporation of 11.20% to 22.40% de-oiled karanj cake in the diet of Japanese quail. But, Natnam *et al.* (1989b) reported a comparable feed efficiency with control diet in broiler chicks by incorporating solvent extracted karanj cake at 10% level in the diet. Efficiency of feed utilization depends on the level of protein and energy (Mellen *et al.,* 1984) and their ratio (Davidson, 1964) in addition to the presence of incriminated factors (Chand, 1987). Probably the presence of higher levels of residual toxic factors in diets containing koroch seed cake at all levels of incorporation resulted in poor feed efficiency in broiler chicks.

Meat yield characteristics

Dietary effect on organs, tissues weight and body development may affect carcass characteristics of birds. The data on carcass traits like dressing percentage, percent live weight of neck, head, gizzard, heart, liver, shank, breast, drumstick, thigh, wing, skin and abdominal fat have been set out in Table 7. All the parameters determined showed a non-significant treatment effect except for the percentage of dressing yield, breast, liver and gizzard weight. Percent live weight of dressing yield, gizzard and liver were significantly (P<0.05) influenced by dietary treatments. Dressing percentage of birds fed on 6% koroch seed cake was significantly (P<0.05) depressed compared to any other dietary treatment, whereas birds fed on 2% koroch seed cake exhibited similar results compared with their counterparts on the control diet. The percentage of breast meat was also significantly (P<0.01) decreased for 4% and 6% koroch seed cake dietary group compared to either 2% koroch seed cake or control group. However, liver and gizzard weight increased significantly (P<0.05) due to incorporation of koroch seed cake in the diet at all levels.

Table 7. Meat yield characteristics of broilers fed on oil extracted Koroch *(Pongamia Pinnata)* seed cake up to 28 days of age

Parameter	Different level of oil extracted Koroch seed cake				Significance Level
	0%	2%	4%	6%	
Live weight (g)	1004.5[a]	857[b]	836[b]	816[b]	*
Dressing yield (%)	64.97[a]	64.91[a]	62.05[ab]	59.59[b]	*
Blood (%)	5.34	4.32	4.19	3.60	NS
Feather (%)	3.55	5.03	3.96	3.60	NS
Neck (%)	1.99	2.04	2.04	2.02	NS
Head (%)	3.13	3.41	3.12	3.14	NS
Gizzard (%)	1.79[a]	1.82[ab]	2.17[b]	2.39[b]	*
Heart (%)	0.35	0.35	0.41	0.32	NS
Liver (%)	2.93[a]	2.79[ab]	3.16[ab]	3.61[b]	*
Shank (%)	1.94	1.93	1.97	1.89	NS
Breast (%)	13.00[a]	13.60[a]	10.62[b]	9.90[b]	**
Drumstick (%)	5.07	5.02	5.48	6.14	NS
Thigh (%)	7.46	7.04	6.71	6.83	NS
Wing (%)	3.49	3.64	3.22	3.41	NS
Skin (%)	1.94	2.21	2.22	2.16	NS
Abdominal fat (%)	0.89	0.99	0.82	0.62	NS

[a,b] Mean values with different superscripts within same row differ significantly; NS=Non-significant; **=significant (p<0.01)

Mandal and Banerjee (1982) reported no difference in organ weights like liver, heart, kidney and spleen of cockerels due to dietary replacement of black til cake with de-oiled karanj cake at 30% level. Dhara *et al*. (1997) also found no significant variation in weight of different commercial cuts (neck, wing, thigh, shank, breast and trunk) and organs (liver, heart and gizzard) due to incorporation of deoiled karanj cake upto 22.40% in the diet of Japanese quail. However, in the present study, dietary inclusion of koroch seed cake significantly decreased the weight of dressing yield and breast meat.

Panda et al. (2008) observed that the dietary inclusion of either solvent extracted karanj cake (SKC) or NaOH treated SKC at 25% level or $Ca(OH)_2$ treated SKC at 12.5% and 25% levels significantly increased the weight of liver leading to liver hypertrophy. Gizzard weight also increased significantly due to incorporation of SKC at both levels. These findings are similar to the findings of the present study where liver and gizzard weight increased significantly due to incorporation of koroch seed cake in broiler diet at all levels.

Panda *et al.* (2008) noticed that the adverse effect on growth and feed intake was found when daily karanj intake was 18mg and above. Similarly, Natanam (1989a) reported that the adverse effect of karanj cake feeding was due to the leftover of karanj oil in the processed cake. Probably the higher daily karanj intake (>18mg) could be the potential reason for showing adverse effect on growth and meat yield characteristics of brolers in the present study.

CONCLUSION

The results revealed that the feeding of koroch seed cake to broilers had no improvement on growth rate and feed conversion efficiency up to 28 days. However, treatment of koroch seed cake might be potentially beneficial to the performance of broiler.

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