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Effect of dietary replacement of protein with seabuckthorn products alone and in combination on the performance of broiler birds

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Abstract

An experiment was conducted to study the effect of seabuckthorn (SBT) leaves, cake and pomace alone and in combination on broilers production. Trial was conducted in 192 day old chicks which were divided into 8 groups with 3 replications having 8 chicks in each. Chicks were offered conventional rations in control (T_0) group and replacing 6,20,10,26,30,16 and 36 percent CP by SBT leaves, cake and pomace, leaves+cake, cake+pomace, pomace+leaves, leaves+cake+pomace, respectively.The feed intake, overall body weight gain and feed conversion ratio were recorded throughout the experimental period. The overall broiler performance did not significantly improved in respect of GW, FI and FCR by the inclusion of SBT leaves, cake and pomace alone or in combination in the feed. The inclusion of SBT leaves, cake and pomace in the feed had no effect on dressing percentage, mortality and serum mineral levels. From the overall study it was concluded that there was no effect of the different test feeds on the broiler production by feeding the sea-buckthorn leaves, cake and pomace alone or in combination.

Introduction

Seabuckthorn (*Hippophae rhamnoides* L.) is a plant which can be exploited as non conventional feed resource (NCFR).The inclusion of seabuckthorn (SBT) products such as leaves, cake or pomace as a feed concentrate mixture may be of economic relief for the poultry farmers of high altitude areas where this plant is grown widely and abundantly. The seabuckthorn female plants produce orange coloured soft and juicy berries 6–9 mm in diameter, which are rich in vitamin C (on average 600 mg per 100 g and sometimes up to 1500 mg per 100 g). Some varieties are also rich in vitamin A, vitamin E, and oils. The industrial wastes of different parts of seabuckthorn are available as by-products, which could be used as various types of feed supplements and additives to the animals. During industrial processing, the leaves and left-over of fruit-pulp (pomace and pressed seed-cake) can be used as an alternate feed source for different categories of animals due to its nutritional worth. The seed from fruit-pulp can be used after oil extraction as cake. The leaves are very nutritious and can be fed to the animals after value addition.

As protein is the most expensive nutrient, by introducing new protein source in broiler feeds, we can certainly decrease the cost of production and the poultry birds can be reared efficiently. Feed processing operation such as grinding, mixing and pelleting are likely to have a great influence on feed quality and broiler performance (Behnak and Beyer, 2012) and the fruit industry by-product can be used in any form of feed. Keeping in view the usefulness of seabuckthorn leaves, cakes and pomace, it will be of great importance to evaluate its nutrient utilization in commercial poultry birds. Feeding of the leaves, cakes and pomace may meet appreciable amount of the nutrient requirements of commercial broiler birds benefiting the poultry farmer. So an attempt was made under this study to see the effect of dietary replacement of protein with seabuckthorn products alone and in combination on the performance of broiler birds.

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Materials and Methods

The experiment was conducted on 192 numbers of day old broiler chicks for a period of 42 days. The chicks were wing banded, weighed and randomly allocated to 8 treatments with 3 replications each with 8 chicks and were provided with starter phase diet from 2nd day onward. The crude protein (CP) of the traditional concentrate ration of control group (T_0) of the poultry broilers was replaced with crude protein of leaves, cake and pomace of SBT in T_1,T_2 and T_3 treatment groups at 6, 20 and10 per cent levels respectively, whereas 6 percent + 20 percent (leaves+cake) in T_4, 20 percent + 10 per cent (cake+pomace) in T_5, 6 percent + 10 percent (leaves+pomace) inT_6, 6 percent+20 percent+10 percent (leaves+cake+pomace) in T_7 treatment group, respectively. The layout of the experiment has been given in table 1. The chicks were housed in battery cage system and reared from day old to 42 days of age following standard managemental practices. The feed and water were provided daily throughout the experimental period. The effect of dietary replacement of tradition concentrate ration crude protein on the broilers overall body weight gain, feed intake, mortality and feed conversion ratio were determined. The data were analyzed by using one-way analysis of variance and Tukey's test was applied for comparison of different treatments by using Statistical Package, Graph Pad Instat™. of Russel.

Table 1: Lay out of the experiment

Sr. No.	Treatment Particular	Abbreviations for the treatment	Nos. of birds per treatment with 3 replications	
			Starter phase	Finisher phase
1	Control	T-C	8x3=24	8x3=24
2	6% Crude protein of Control feed replaced with crude protein of seabuckthorn leaves	T-1	8x3=24	8x3=24
3	20% Crude protein of Control feed replaced with crude protein of seabuckthorn cake	T-2	8x3=24	8x3=24
4	10% Crude protein of Control feed replaced with crude protein of seabuckthorn pomace	T-3	8x3=24	8x3=24
5	6% +20% Crude protein of Control feed replaced with crude protein of seabuckthorn leaves and cake.	T-4	8x3=24	8x3=24
6	20%+10% Crude protein of Control feed replaced with crude protein of seabuckthorn cake and pomace.	T-5	8x3=24	8x3=24
7	6%+10% Crude protein of Control feed replaced with crude protein of seabuckthorn leaves and pomace.	T-6	8x3=24	8x3=24
8	6% +20% +10% Crude protein of Control feed replaced with crude protein of seabuckthorn leaves, cake and pomace	T-7	8x3=24	8x3=24

Result and Desicussion

The chemical composition of the various ingredients used for the formulation of various ingredients and chemical composition of starter phase and finisher phase feeds has been given in Table 2, 3 and 4, respectively.

The DM content of the starter phase feed was found to be 92.50, 92.76, 91.90, 91.79, 91.74, 92.03, 91.52, and 91.03 per cent in T_0, T_1, T_2, T_3, T_4, T_5, T_6, and T_7 treatment groups, respectively. The DM of the test feed varied from 91.03 to 92.76 per cent being minimum in T_7 and maximum in T_1 treatment groups. As far as possible the diets formulated were kept iso-proteineous and iso-caloric. The protein concentration in T_0, T_1, T_2, T_3, T_4, T_5, T_6 and T_7 was found to be 19.14, 18.90, 18.95, 19.18, 19.24, 19.15, 18.76 and 19.13 per cent in different treatment groups, respectively. The protein concentration of the test feed ranged from 18.76 to 19.24 per cent, where it was highest in T_4 and lowest in T_6 treatment group. The EE of the starter feed was found to be 5.37, 5.74, 5.22, 5.79, 5.56, 5.57, 5.54 and 5.44, per cent in T_0, T_1, T_2, T_3,

The final weight, GIW, FI, FCR, mortality, live ability and dressing percentage have been presented in Table 5. The body weights of the experimental groups birds fed leaves, cake and pomace alone and or in combination has not improved the body weight gain of the broilers at the end of the experiment and did not differ significantly as compared to control group where tradional concentrate mixture was

Table 2: Chemical composition of feed ingredients

Feed Ingredients	DM (%)	CP (%)	EE (%)	CF (%)	Total Ash (%)	NFE (%)	AIA (%)	Ca (%)	P (%)	ME (Kcal/Kg)
Maize	93.00	9.86	3.91	2.19	1.54	82.5	0.38	0.35	0.75	3303.93
De-oiled rice bran	91.59	14.72	1.27	14.07	9.91	60.03	3.40	0.05	1.19	2527.96
Groundnut cake	95.52	37.30	7.90	10.89	6.72	37.19	2.23	0.23	0.67	3010.93
Soya flakes cake	92.29	33.84	1.10	7.79	8.40	48.87	1.10	0.29	0.64	2777.64
Fish meal	91.37	42.26	4.20	5.71	13.50	34.33	10.80	3.72	2.42	2805.81
Rice polish	91.90	11.39	13.49	6.20	11.06	57.86	3.63	0.08	1.40	3252.70
Seabuckthorn cake	90.00	26.00	4.48	14.00	2.50	53.02	2.61	0.50	2.70	2906.64
Seabuckthorn leaves	90.05	17.33	10.80	5.16	7.14	59.57	0.02	3.66	0.18	3305.34
Seabuckthorn pomace	93.00	11.12	6.80	8.00	4.40	79.68	2.05	5.43	1.68	3466.79
Feed Ingredients	**DM (%)**	**CP (%)**	**EE (%)**	**CF (%)**	**Total Ash (%)**	**NFE (%)**	**AIA (%)**	**Ca (%)**	**P (%)**	**ME (Kcal/Kg)**
Maize	93.00	9.86	3.91	2.19	1.54	82.5	0.38	0.35	0.75	3303.93
De-oiled rice bran	91.59	14.72	1.27	14.07	9.91	60.03	3.40	0.05	1.19	2527.96
Groundnut cake	95.52	37.30	7.90	10.89	6.72	37.19	2.23	0.23	0.67	3010.93
Soya flakes cake	92.29	33.84	1.10	7.79	8.40	48.87	1.10	0.29	0.64	2777.64
Fish meal	91.37	42.26	4.20	5.71	13.50	34.33	10.80	3.72	2.42	2805.81
Rice polish	91.90	11.39	13.49	6.20	11.06	57.86	3.63	0.08	1.40	3252.70
Seabuckthorn cake	90.00	26.00	4.48	14.00	2.50	53.02	2.61	0.50	2.70	2906.64
Seabuckthorn leaves	90.05	17.33	10.80	5.16	7.14	59.57	0.02	3.66	0.18	3305.34
Seabuckthorn pomace	93.00	11.12	6.80	8.00	4.40	79.68	2.05	5.43	1.68	3466.79

Table 3: Chemical composition of broiler starter feed

Particulars	T_0	T_1	T_2	T_3	T_4	T_5	T_6	T_7
Dry matter	92.50	92.76	91.90	91.79	91.74	92.03	91.52	91.03
Crude protein	19.14	18.90	18.95	19.18	19.24	19.15	18.76	19.13
Ether extract	5.37	5.74	5.22	5.79	5.56	5.57	5.54	5.44
Crude fiber	6.18	6.10	6.79	6.05	6.80	6.60	6.20	6.66
Total ash	5.44	5.52	4.98	5.52	5.62	5.60	5.44	5.13
Acid insoluble ash	2.06	1.94	2.19	2.15	2.18	2.30	2.00	1.97
Nitrogen free extract	63.87	63.74	64.06	63.46	62.78	63.08	64.06	63.64
Metabolisable energy	2962.91	2978.53	2910.54	2941.61	2952.72	2948.30	2959.55	2971.50
Calcium	11.94	8.70	7.38	10.80	6.33	7.08	8.37	8.79
Phosphorus	5.93	0.53	0.51	0.55	0.59	0.52	0.59	0.49

Table 4: Chemical composition of finisher feeds

Particulars	T_0	T_1	T_2	T_3	T_4	T_5	T_6	T_7
Dry matter	91.69	91.17	90.94	91.69	90.77	90.11	91.53	90.61
Crude protein	17.72	17.67	17.83	17.85	17.77	17.78	17.82	17.83
Ether extract	4.88	5.15	5.03	5.01	5.15	5.25	4.87	4.93
Crude Fiber	5.97	5.28	6.97	6.35	6.72	7.34	6.62	6.95
Total ash	4.77	4.88	4.40	5.29	4.64	4.26	5.19	4.03
Acid insoluble	1.65	1.61	1.79	1.79	1.73	1.60	1.82	1.76
Nitrogen free extract	66.66	67.02	65.77	65.50	65.72	65.37	65.50	66.26
Metabolizable energy	3093.57	3003.57	3082.71	3057.41	3046.97	3094.45	3043.81	3063.55
Calcium	5.43	5.16	3.72	5.25	5.13	5.97	5.94	5.80
Phosphorus	0.52	0.51	0.53	0.52	0.49	0.52	0.54	0.57

Table 5: Overall Biological Performance of Broilers offered feed from Ist day to 6th week of age

Particulars	T_0	T_1	T_2	T_3	T_4	T_5	T_6	T_7
Initial body weight (g)	61.62 ±0.94	61.36 ±0.97	61.10 ±1.07	60.62 ±0.95	60.71 ±1.02	60.40 ±1.90	60.31 ±0.90	60.07 ±1.22
Body Weight at the end of 6th week (g)	868.09^{a} ±39.99	774.13^{ab} ±31.07	780.48^{ab} ±41.50	750.86^{ab} ±48.24	743.42^{abc} ±29.81	793.91^{ab} ±29.81	697.92^{bc} ±33.71	610.87^{c} ±24.94
Gain in weight (g)	806.49^{a} ±49.28	712.77^{a} ±30.90	719.38^{a} ±48.33	690.24^{ab} ±47.68	682.71^{ab} ±29.64	733.51^{ac} ±44.81	637.61^{ab} ±33.85	550.80^{b} ±31.44
Feed intake (g)	2773.74^{a} ±33.44	2494.55^{b} ±31.77	2552.43^{b} ±22.41	2591.10^{b} ±19.77	2707.56^{a} ±29.30	2977.86^{c} ±19.47	2641.44^{a} ±20.40	2365.00^{b} ±21.37
Feed conversion ratio	3.44^{a} ±0.22	3.50^{a} ±0.23	3.55^{a} ±0.19	3.75^{a} ±0.14	3.97^{a} ±0.10	4.06^{b} ±0.13	4.14^{b} ±0.25	4.29^{b} ±0.27
Mortality (%)	8.33	4.17	4.17	4.17	4.17	4.17	Nil	Nil
Liveability (%)	91.67	95.83	95.83	95.83	95.83	95.83	100.00	100.00
Dressing (%)	65.89 ±8.11	64.91 ±7.22	63.23 ±9.23	64.50 ±7.36	64.90 ±8.37	64.81 ±7.13	63.25 ±7.92	63.15 ±9.20

offered. FI was significantly (P<0.05) highest in T_5 and significantly (P<0.05) the lowest in T_7 treatment group. FCR for overall phase of broiler production from Ist day to 6th week varied from 3.44 (T_0) to 4.29 (T_7). Significantly (P<0.05) poor FCR was observed in T_5, T_6 and T_7 treatments birds. It was due to lower GIW compared as to feed consumed. There was no significant differences in dressing percentage amongst different treatments. Mortality for overall phase was found to be 8.33, 4.17, 4.17, 4.17, 4.17, 4.17, nil, and nil in T_0, T_1, T_2, T_3, T_4, T_5, T_6 and T_7 treatment groups, respectively. No mortality was observed in T_6 and T_7 and highest was observed in T_0 treatment group. These mortality values were natural and not due to the effect of feed as revealed by postmortem reports of the poultry birds.

The results of this study were in contradiction to that of Ambetkar (2009) where she replaced the CP of the basal diet with 3 to 15 per cent CP of the SBT leaves and observed that the body weight (g) at the end of 6th week increased upto 6 per cent replacement and weight decreased with the increase in level of addition of SBT leaves. In this study the body weight at the end of the 6th week decreased. Another such study carried out by Guleria (2010) where he replaced the CP of the basal diet with 5 to 60 per cent SBT cake and observed that there was simple decrease in the weight of the poultry broiler upto 20 percent level. A comparative study of introduction of SBT leaves and cake was carried out by Sharma (2010). He replaced the CP of basal diet of the poultry broilers with CP of SBT leaves at 3, 6 and 9 per cent leaves and CP of SBT cake at 10, 20 and 30 per cent leaves in the 6 experimental treatments groups. He observed that weight at the end of experiment increased at 3 per cent level of introduction and then decreased at 6 and 6 per cent level of introduction of SBT leaves and decreased with 20 per cent level of introduction of SBT cake.

The figures bearing different superscripts in a row differ significantly (P<0.05).

Conclusions

From the overall study it was concluded that there was no effect of the different test feeds on the broiler production by feeding the seabuckthorn leaves, cake and pomace alone or in combination.

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