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Article

Effect of dietary Halquinol supplementation on the productive performances, carcass traits and blood profile of Sonali chicken

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Abstract: This study was conducted to evaluate the efficacy of dietary supplementation of Halquinol on productive performances, carcass characteristics and hematological parameters of Sonali chicken. A total number of 72 Sonali chicks of 07 days old were divided randomly into 04 experimental groups occupying 03 replications in each groups among which four dietary groups were considered i.e. control group (T_0), Halquinol @ 0.25g/ kg feed in group (T_1); Halquinol @ 0.5g/ kg feed in group (T_2); and Halquinol @ 1g/ kg feed in group (T_3) respectively. Results indicated that body weight and body weight gain were increased significantly ($P<0.05$) in birds supplied with Halquinol @ 1g/ kg feed group (T_3) compared to the other groups. Higher ($P<0.05$) feed intake and better ($P<0.05$) FE were also observed in group T_3 compared to the other groups. This result also indicated that body weight, body weight gain, feed intake, and feed efficiency were increased along with increasing dose of Halquinol. No significant ($P>0.05$) differences were found in dressing percentage, liver, heart and gizzard among the dietary treatment groups. However, the dressing weight, breast meat, thigh meat, and head weight was significantly ($p<0.05$) higher in birds supplied with Halquinol @ 1g/ kg feed group (T_3) compare to control (T_0) group. Present study revealed that hematological parameters, including Hb, PCV and ESR value of the birds of different groups does not differ significantly among the groups and it was within the normal range. Cost effective analysis of the experiment demonstrated that by using Halquinol @ 1g/ kg feed significantly ($P<0.05$) higher net profit than other dietary treatment groups and also highest profit over control (14.95Tk.). Based on the results of present study it may be suggested that supplementation of Halquinol can be used as a commercial growth promoter for the production of Sonali chicken.

Keywords: Halquinol; Sonali chicken; productive performances; carcass characteristics; hematological parameters

1. Introduction

Poultry is a promising sector for poverty reduction in Bangladesh. For fulfilling the protein demand of human poultry industry plays an important role in Bangladesh (Islam *et al*., 2014). About 37% of the total meat production in Bangladesh contributes alone by poultry meat (Begum *et al*., 2011). The demand for meat is 7.05 million metric ton, and of egg is 16744 million in number. Each year the deficits of the meat is 0.9 million metric ton, and of the eggs is 4831.60 million in Bangladesh (DLS, 2016). The Sonali chicken first started rearing in 1996–2000 in Northern part of Bangladesh through SLDP (Smallholder Livestock Development Project) and PLDP (Participatory Livestock Development Project) is a cross-breed of Rhode Island Red (RIR) cocks and Fayoumi hens having similar phenotypic appearance of deshi chickens of Bangladesh (Uddin *et al*., 2015). In 2010 about 150.9 million Sonali DOCs were produced, representing about 35 percent of the country's total commercial broiler and layer production, it indicates the Sonali population is increasing gradually to meet the consumer demand (Huque, 2011). More or less about 65-70 percent of total cost is the feed cost of Sonali chicken production. For this, it is required to develop various effective feed at a reasonable price (Bunyan *et al.*, 1977). To maintain the good health condition and feed efficiency of birds farmers often extensively uses antibiotics on feed that causes a great threat to the human being. Various research implemented to find the alternatives of antibiotics likes organic acids, prebiotics, probiotics, and plant extracts that provides similar results in the prevention and control of infectious diseases which finally promotes the growth enhancing action and improved feed efficiency (Wolfenden *et al.,* 2007). Halquinol is very powerful non-antibiotic antibacterial, antifungal and antiprotozoal feed additive or as a growth promoter in swine and poultry industry. Malabsorbtion syndrome is overcomed by using Halquinol as it has wide spectrum of activity and slows down peristalsis in the gut (Nischal *et al*., 2012). Halquinol is used mainly as an effective gut acting compound though gastrointestinal tract cannot absorb the halquinol. It is a triple acting antidiarrhoeal product effective against bacteria, fungi and protozoa. It offers minimum or no resistance in bacteria even on long-term use. By incorporating halquinol with feed at different levels is being used to overcome several challenges in modern poultry and swine farming, like microbial infections, and for growth promotional aspects, because of its broad-spectrum antimicrobial having antibacterial, antifungal and antiprotozoal activities (Wojtowicz, 1984). So, Halquinol is a potential agent which may be successfully used as a non-harmful non-antibiotic growth promoter for the improvement of productive performances of Sonali chicken. Therefore, present study was designed to know the effect of dietary supplementation of halquinol on productive performances, carcass characteristics, hematological parameters & to evaluate the economic efficiency of using halquinol on Sonali chicken production.

2. Materials and Methods

A total of 72, 07 days old Sonali chicks were purchased from the Sale Centre of Polly hatchery limited, Joypurhat, Trade point Saidpur were equally and randomly divided and distributed into four dietary groups (T_0, T_1, T_2 and T_3) having three replications in each groups and each replication contains 6 birds. Group T_0 was considered as control and fed with only commercial ration and adlibitum fresh drinking water. Group T_1 was treated with supplementation of Halquinol at the rate of 0.25g/ kg feed and adlibitum fresh drinking water. Group T_2 was treated with supplementation of Halquinol at the rate of 0.5g/ kg feed and adlibitum fresh drinking water. Group T_3 was treated with supplementation of Halquinol at the rate of 1g/ kg feed and adlibitum fresh drinking water. At 07 days of ages, initial live weight of each bird was recorded just prior to separation. After weighing experimental birds were kept into separate bamboo made cage floor .Then their performance including live weight, feed intake and mortality were recorded weekly till the end of the experiment. After completing the experiment blood was collected and conducted the hematological tests (Hb, ESR and PCV). To determine the carcass characteristics a total of 12 birds were slaughtered and their carcass and organs were weighed. The experimental diet was provided into two phages (Sonali-mash starter and Sonali-mash grower), mash starter was provided 0 to 30 days and mash grower was days 31 to end day of experiment. The nutrient requirements (ME, CP, CF, EE, Ca, P, Lysine and Methionine) were satisfied as per requirement as recommended for Sonali chicken diet and also same for all treatment groups. Fresh and dried rice husk was used as litter at a depth 2-3 inch. After 5 weeks old litter was totally removed and new litter was provide as same depth. The litter was stirred one time per day from four weeks to upto end day of experimental period. One round tube feeder and one round drinker were provided in each pen. The feeder and drinker were fixed in such a way that the Sonali chicken were able to eat and drink conveniently. Feeders were cleaned everyday while waterers were cleaned every day at morning and afternoon. Experimental birds were vaccinated against Newcastle Disease (*Ranikhet*), Infectious Bronchitis and Infectious Bursal Disease (Gumboro) as per recommendation of the manufacturer. Strict bio-security was maintained to prevent the disease outbreak in the farm. Experimental birds were weighed weekly by using digital balance and their growth rate was measured. Blood was collected from the wing vein of the experimental birds and kept in sterile test tubes containing anticoagulant (EDTA). Then the hematological tests were performed. The birds were fasted for 8 hours prior to slaughter, but water was provided adlibitum. Two birds were randomly selected in each replication for slaughtering. After that removal of shank, head and skin. Finally evisceration was done manually to separate liver, spleen, heart, gizzard, and meat yield. Different organs weight such as head, heart, liver, gizzard, thigh meat and breast meat were taken by the electric balance at the end of the experiment. All data were analyzed by

SPSS version-20 software by using one way ANOVA accordance with the principles of Complete Randomized Design (CRD). All values were expressed as Mean± SEM and significance was determined when ($P<0.05$). Mean was compared among the treatment groups by using Duncan test.

3. Results

3.1. Body weight and body weight gain

Effect of Halquinol on body weight and body weight gain of Sonali chicken is shown in Tables 1 and 2. At the end of the experiment the birds supplied with Halquinol in group T_3 (793.3 ±3.47 g/bird) significantly highest ($p<0.05$) body weight was observed compare to supplied with Halquinol in group T_2 (743.4±3.00 g/bird), T_1 (718.3 ±0.95 g/bird) and control group T_0 (674.4 ± 4.82 g/bird) respectively whereas initial body weight was similar in all groups. The live weight of birds in 2nd, 3rd, 4th and 5th weeks did not significantly ($P<0.05$) vary among the treatment groups. But the live weight of 6th, 7th, 8th and 9th weeks there were a significant ($p<0.05$) differences among the treatment groups. Significant difference ($p<0.05$) in body weight gain was observed among the groups but in case of 2nd, 3rd, 4th and 5th weeks no significant differences ($P>0.05$) were observed among the birds of different experimental groups. The significantly highest body weight gain was found in group T_3 (716.0±3.64 g/bird) than other groups T_2 (665.9±2.71 g/bird), T_1 (640.9 ±0.92 g/bird) as well as lowest in control group T_0 (597.1±4.65 g/bird).

3.2. Feed intake

Table 3 demonstrates the result of feed intake at different ages of Sonali chicken with different treatment groups. The feed intake of Sonali chicken in different dietary treatment during 2nd, 3rd, 4th, 6th and 7th weeks of age of experimental periods was almost statistically similar and the differences were insignificant ($p>0.05$). But the 5th, 8th, and 9th of ages the feed intake of Sonali chicken in different dietary treatment during experimental periods were significantly ($p<0.05$) varied. At 5th weeks of age significantly ($p<0.05$) highest feed intake was found in birds supplied with Halquinol in group T_3 (208.9±1.01g/bird), and lowest feed intake was found in birds supplied with Halquinol in group T_2 (206.0 ±0.40g/bird). Significantly ($p<0.05$) highest feed intake was found in birds at 8th weeks of age supplied with Halquinol in group T_3 (289.3 ±3.70 g/bird), and lowest feed intake was found in control group T_0 (273.9 ±3.89 g/bird). At 9th week of age significantly ($p<0.05$) highest feed intake was found in birds supplied with Halquinol in group T_3 (316.4 ±2.11g/bird), and lowest feed intake was found in control group T_0 (297.2±7.35g/bird). The cumulative feed intake was found highest in birds supplied with Halquinol in group T_3 (1697.9±4.31g/bird) compared to other groups T_2 (1692.2 ±3.78 g/bird), T_1 (1683.7±6.04 g/bird) and lowest feed intake was found in control group T_0 (1657.4±9.02 g/bird) for the whole experiment period.

3.3. Feed efficiency (FE)

The feed efficiency (feed intake in g/ weight gain in g) of Sonali chicken having different dietary treatments shown in Table 4. The feed efficiency of Sonali chicken in different dietary treatment during 2nd, 3rd, 4th and 5th weeks of experimental periods was almost statistically similar and the differences were insignificant ($p>0.05$). But the 6th, 7th, 8th and 9th weeks of ages the feed efficiency of Sonali chicken in different dietary treatment during experimental periods were significantly ($p<0.05$) varied. During 6th, 7th, and 8th weeks of experiment, the feed efficiency was significantly higher ($p<0.05$) in control group T_0 than other groups. At 9th weeks of age birds supplied with Halquinol in group T_1 had significantly highest ($p<0.05$) feed efficiency than all other groups. The cumulative feed efficiency of different treatment groups was statistically significant ($P<0.05$). The birds supplied with Halquinol in group T_3 (2.37 ±0.01) converted feed to meat most efficiently followed by birds supplied with Halquinol in group T_2 (2.54 ±0.01), birds supplied with Halquinol in group T_1 (2.63±0.01) and control group T_0 (2.77 ±0.01).

3.4. Edible meat yield characteristics

Meat yield Characteristics of Sonali chicken supplemented with Halquinol is represented below in Table 5. Dressing percentage, liver, heart and gizzard weight did not significantly differed ($p>0.05$ among the experimental birds. However dressing weight, thigh weight, breast weight, head and shank weight were significantly higher in the Sonali chicken supplemented with Halquinol compare to the control group except the shank weight were similar incase of T_0 and T_1 groups. The significantly highest dressing weight was found in group T_3 (407.33±10.35 g) and lowest in control T_0 (353.33±3.71 g) group. It was seen that relatively the highest dressing percentage was observed in birds supplied with Halquinol in group T_3 (51.67±0.97%) than other treatment groups like T_2 (50.39±0.50%), T_1 (50.27±0.09%), and in group T_0 (50.03±0.03%) respectively. Liver weight maximum in T_1 treatment group and minimum in T_0 treatment group. Heart weight was similar among the dietary treatment groups while gizzard weight was maximum found in T_3 (26.67±1.76 g) treatment group and minimum in T_0 (22.67±0.67 g) treatment group. Breast meat weights obtained were significantly higher in the Sonali chicken supplemented with Halquinol compare to the control group. Relatively the highest breast meat weight was observed in birds supplied with Halquinol in group T_3 (116.00±2.31 g) than other treatments groups like in T_2 (105.33±1.76 g), T_1 (103.33±0.67 g) and T_0 (100.67±0.67 g) respectively. Thigh meat weight was significantly higher in the Sonali chicken supplemented with Halquinol compare to the control group and best result was found in the birds supplied with Halquinol 1g/kg feed. The head weight were significantly higher in the Sonali chicken supplemented with Halquinol compare to the control group and highest result found in the T_3 treatment group and lowest result found in the control group T_0. It was also found that the shank weight of Sonali chicken on day 63 were significant, the relatively the heavier shank weight was observed in group T_3 and lowest shank weight was observed in control group T_0 and T_1 groups.

3.5. Hematological parameters

Table 6 represents the effect of Halquinol on blood parameters of experimental Sonali chicken. It was found that Packed Cell Volume (PCV) was not significantly differed (P>0.05) among the different groups of Sonali chicken (26.00, 26.67, 27.67 and 27.00 % in T_0, T_1, T_2 and T_3 group, respectively). Hemoglobin (Hb) was 8.14, 8.16, 8.16 and 8.18 g/dl in T_0, T_1, T_2 and T_3 group, respectively which was not significantly (P>0.05) differed among the groups. Erythrocyte sedimentation rate (ESR) was not significantly differed (P>0.05) among the treatment and control groups and it was 8.07, 8.07, 8.07, and 8.07 mm in T_0, T_1 and T_2 group, respectively.

3.6. Cost effectiveness of production

Cost effective analysis for Sonali chicken production fed on Halquinol showed in Table 7. At the end of the experiment total production cost per birds was Tk. 93.31, 94.54, 95.06 and 95.76 for control group (T_0), T_1, T_2 and T_3 group, respectively. Compare to the control group total profit per birds of Sonali chicken were higher in group T_3 (Tk. 3.84 vs. Tk. 18.79) followed by the group T_2 (Tk. 12.24), and T_1 (Tk. 9.86) group.

Table 1. Effect of dietary supplementation of Halquinol (Gutcare®) on live weight of Sonali chicken.

Body weight (g/bird/wks)	Dietary treatments				Level of significance
	T_0	T_1	T_2	T_3	
Initial Live Weight at 1st wk.	77.3±0.17	77.4 ± 0.42	77.5 ± 0.29	77.3± 0.17	NS
2nd wks	133.3 ±0.17	134.0 ±0.58	134.4 ±0.97	134.3 ± 0.67	NS
3rd wks	200.9 ±0.49	201.4 ±0.61	201.8 ±0.72	202.0 ± 1.15	NS
4th wks	284.3 ±0.88	283.9 ± 0.94	286.5± 0.29	286.5 ±1.77	NS
5th wks	387.0 ±2.64	390.1 ±2.57	392.2 ±3.97	398.3± 4.18	NS
6th wks	453.2 ±2.14 ^{a}	466.8 ±0.96 ^{b}	485.6 ±1.85 ^{c}	498.9 ±1.04 ^{d}	*
7th wks	525.3 ±4.09 ^{a}	550.5 ±1.47 ^{b}	565.6 ±1.20 ^{c}	590.9 ±3.93 ^{d}	*
8th wks	598.8 ±1.13 ^{a}	640.8 ±4.14 ^{b}	652.4 ±1.89 ^{c}	699.9 ±1.93 ^{d}	*
9th wks	674.4 ±4.82 ^{a}	718.3 ±0.95 ^{b}	743.4 ±3.00 ^{c}	793.3 ±3.47 ^{d}	*

Legends: T_0= Control, T_1= Halquinol@0.25g/kg feed, T_2= Halquinol@0.5g/kg feed, T_3= Halquinol@1g/kg feed. The mean values with different superscript (a to d) within the same row differs significantly, at least (p<0.05). All values indicate mean ± Standard error of mean

NS=Non significant, * statistically significant (P<0.05).

Table 2. Effect of dietary supplementation of Halquinol (Gutcare®) on live weight gain of Sonali chicken.

Body weight gain (g/bird/wks)	Dietary treatments				Level of significance
	T_0	**T_1**	**T_2**	**T_3**	
2^{nd} wks	56.0 ±0.30	56.6 ±0.61	56.9 ±0.84	57.0.±0.52	NS
3^{rd} wks	67.7 ±0.49	67.4 ±0.42	67.4±1.54	67.7 ±0.67	NS
4^{th} wks	83.4±0.52	82.5±0.78	84.7±1.00	84.5 ±.87	NS
5^{th} wks	102.7±1.76	106.2±2.65	105.7 ±4.00	111.8 ±2.40	NS
6^{th} wks	66.2 ± 0.61 ^{a}	76.7 ± 2.34 ^{b}	93.4 ± 2.12 ^{c}	100.6 ± 3.52 ^{c}	*
7^{th} wks	72.1 ±5.79 ^{a}	83.8 ±0.62 ^{bc}	80.0 ±1.15 ^{ab}	91.8±3.38 ^{c}	*
8^{th} wks	73.5 ±5.15 ^{a}	90.3 ±2.76 ^{b}	86.8 ±1.01 ^{b}	109.0±2.15 ^{c}	*
9^{th} wks	75.6 ±4.13 ^{a}	77.5 ±3.69 ^{a}	91.0±1.20 ^{b}	93.4 ±3.48 ^{b}	*
Total	597.1±4.65 ^{a}	640.9 ±0.92 ^{b}	665.9±2.71 ^{c}	716.0±3.64 ^{d}	*

Legends: T_0= Control, T_1= Halquinol@0.25g/kg feed, T_2= Halquinol@0.5g/kg feed, T_3= Halquinol@1g/kg feed. The mean values with different superscript (a to d) within the same row differs significantly, at least ($p<0.05$). All values indicate mean ± Standard error of mean
NS=Non significant, * statistically significant ($P<0.05$).

Table 3. Effect of dietary supplementation of Halquinol (Gutcare®) on Feed intake of Sonali Chicken.

Feed intake (g/bird/wks)	Dietary treatments				Level of significance
	T_0	**T_1**	**T_2**	**T_3**	
2^{nd} wks	102.0±0.51	102.7±0.58	102.3±0.20	102.8±0.29	NS
3^{rd} wks	126.5±0.39	126.3±0.20	126.7±0.37	126.7±0.40	NS
4^{th} wks	173.3±0.58	173.2±0.29	173.7±0.49	173.9±0.67	NS
5^{th} wks	206.2 ±0.29 ^{a}	206.1 ±0.66 ^{a}	206.0 ±0.40 ^{a}	208.9±1.01 ^{b}	*
6^{th} wks	226.1±0.29	225.6±0.69	226.9±0.29	225.4±0.47	NS
7^{th} wks	251.9±1.90	255.3±0.78	255.0±0.58	254.4±1.04	NS
8^{th} wks	273.9 ±3.89 ^{a}	286.4 ±0.69 ^{b}	286.7 ±0.95 ^{b}	289.3 ±3.70 ^{b}	*
9^{th} wks	297.2 ±7.35 ^{a}	308.0±4.53 ^{ab}	315.0 ±2.54 ^{b}	316.4 ±2.11 ^{b}	*
Total (Avg.)	1657.4±9.02 ^{a}	1683.7±6.04 ^{b}	1692.2 ±3.78 ^{b}	1697.9±4.31 ^{b}	*

Legends: T_0= Control, T_1= Halquinol@0.25g/kg feed, T_2= Halquinol@0.5g/kg feed, T_3= Halquinol@1g/kg feed. The mean values with different superscript (a to d) within the same row differs significantly, at least ($p<0.05$). All values indicate mean ± Standard error of mean
NS=Non significant, * statistically significant ($P<0.05$).

Table 4. Effect of dietary supplementation of Halquinol (Gutcare®) on feed efficiency of Sonali chicken.

Age (wks)	Dietary treatments				Level of significance
	T_0	**T_1**	**T_2**	**T_3**	
2^{nd} wks	1.82±0.02	1.81±0.01	1.79±0.03	1.80±0.02	NS
3^{rd} wks	1.87 ±0.01	1.87 ±0.01	1.88 ±0.05	1.87±0.01	NS
4^{th} wks	2.08±0.01	2.10±0.02	2.05±0.03	2.06±0.03	NS
5^{th} wks	2.01 ±0.03	1.94±0.06	1.95±0.07	1.87±0.03	NS
6^{th} wks	3.41 ±0.03 ^{c}	2.95 ±0.10 ^{b}	2.43 ±0.05 ^{a}	2.25 ±0.08 ^{a}	*
7^{th} wks	3.53 ±0.24 ^{b}	3.05 ±0.03 ^{a}	3.19 ±0.04 ^{ab}	2.78 ±0.09 ^{a}	*
8^{th} wks	3.76 ±0.23 ^{c}	3.17 ±0.11 ^{b}	3.30 ±0.05 ^{b}	2.66 ±0.02 ^{a}	*
9^{th} wks	3.94 ±0.13 ^{b}	3.98 ±0.13 ^{b}	3.46 ±0.05 ^{a}	3.40 ±0.14 ^{a}	*
Total (Avg.)	2.77 ±0.01 ^{d}	2.63±0.01 ^{c}	2.54 ±0.01 ^{b}	2.37 ±0.01 ^{a}	*

Legends: T_0= Control, T_1= Halquinol@0.25g/kg feed, T_2= Halquinol@0.5g/kg feed, T_3= Halquinol@1g/kg feed. The mean values with different superscript (a to d) within the same row differs significantly, at least ($p<0.05$). All values indicate mean ± Standard error of mean
NS=Non significant, * statistically significant ($P<0.05$).

Table 5. Edible meat yield characteristics of Sonali chicken fed diet with Halquinol (Gutcare®).

Parameter	Dietary treatments				Level of significance
	T_0	T_1	T_2	T_3	
Dressing wt. (g)	353.33 ± 3.71^{a}	363.33 ± 2.40^{ab}	377.33 ± 2.40^{b}	407.33 ± 10.35^{c}	*
Dressing (%)	50.03±0.03	50.27±0.09	50.39±0.50	51.67±0.97	NS
Breast meat wt.(g)	100.67 ± 0.67^{a}	103.33 ± 0.67^{a}	105.33 ± 1.76^{a}	116.00 ± 2.31^{b}	*
Thigh meat wt.(g)	61.33 ± 0.67^{a}	62.00 ± 1.15^{a}	62.67 ± 2.40^{a}	70.67 ± 1.76^{b}	*
Head (g.)	27.33 ± 0.67^{a}	31.33 ± 0.67^{b}	29.33 ± 0.67^{ab}	32.00 ± 1.15^{b}	*
Heart (g)	4.00±0.00	4.00±0.00	4.00±0.00	4.00±0.00	NS
Liver (g)	18.67±0.67	22.00±1.15	21.33±0.67	21.33±0.67	NS
Gizzard (g)	22.67±0.67	23.33±0.67	23.33±0.67	26.67±1.76	NS
Shank (g)	30.67 ± 0.67^{a}	30.67 ± 0.67^{a}	32.67 ± 0.67^{ab}	34.67 ± 0.67^{b}	*

Legends: T_0= Control, T_1= Halquinol@0.25g/kg feed, T_2= Halquinol@0.5g/kg feed, T_3= Halquinol@1g/kg feed. The mean values with different superscript (a to d) within the same row differs significantly, at least ($p<0.05$). All values indicate mean ± Standard error of mean
NS=Non significant, * statistically significant ($P<0.05$).

Table 6. Effect of Halquinol (Gutcare®) on blood parameters of Sonali chicken.

Parameter	Dietary treatment				Level of significance
	T_0	T_1	T_2	T_3	
PCV%	26.00 ±1.15	26.67 ±0.67	27.67 ±0.88	27.00±0.58	NS
Hb(g/dl)	8.14 ±0.01	8.16 ±0.02	8.16 ±0.01	8.18 ±0.01	NS
ESR($mm.hr^{-1}$)	8.07±0.07	8.07±0.07	8.07±0.07	8.07±0.07	NS

RBC=Red Blood Cell, WBC=White Blood Cell, Hb = Hemoglobin, PCV= Packed cell volume, and Erythrocyte Sedimentation Rate (ESR).
Legends: T_0= Control, T_1= Halquinol@0.25g/kg feed, T_2= Halquinol@0.5g/kg feed, T_3= Halquinol@1g/kg feed. The mean values with different superscript (a to d) within the same row differs significantly, at least ($p<0.05$). All values indicate mean ± Standard error of mean
NS=Non significant, * statistically significant ($P<0.05$).
*Reference values (Jain 1993).

Table 7. Cost effective analysis of dietary effect of Halquinol (Gutcare®) on Sonali chicken.

Description	To	T_1	T_2	T_3
Cost/chick (taka)	20	20	20	20
Avg. feed consumed kg/birds	1.657	1.684	1.692	1.698
Feed price/kg (taka)	37	37	37	37
Cost of Halquinol (Gutcare®) (tk./bird)	0	0.23	0.46	0.93
Feed cost (tk./ bird)	61.31	62.31	62.60	62.83
Miscellaneous (Tk./ bird)	12	12	12	12
Total cost/bird(Tk.)	93.31	94.54	95.06	95.76
Average live weight (kg)	0.67	0.72	0.74	0.79
Sale price/Kg live wt. (Tk.)	145	145	145	145
Sale price/bird(Tk.)	97.15	104.40	107.30	114.55
Net profit/bird(Tk.)	3.84	9.86	12.24	18.79
Benefit over control/ birds (Tk.)	0	6.02	8.40	14.95

4. Discussion

Present study shows that Halquinol has a significant effect on the body weight and body weight gain of Sonali chicken and best result was found in the birds supplied with Halquinol 1g/ kg feed in group T_3. It was also found that the average feed intake of Sonali chicken in different dietary treatment during experimental periods were significantly ($p<0.05$) varied and highest feed intake was found in the birds supplied with Halquinol 1g/ kg feed in T_3 group. In this study it was also found that Halquinol has a significant effect on the feed conversion efficiency of Sonali chicken. The birds supplied with Halquinol 1g/ kg feed (T_3) converted feed to meat most efficiently than other treatment groups. This result was observed may be due the antimicrobial property of the Halquinol. Halquinol has activity against a wide variety of bacteria, fungi, protozoa and mycoplasmal organisms (Cosgrove and Baines, 1978). Among Gram-negative bacteria, it is effective against *Escherichia coli*, *Salmonella typhimurium*, *Proteus vulgaris* (Cosgrove and Forster, 1980; Cosgrove *et al.,* 1981).. Halquinol has activity against *Vibrio anguillarum*, a Gram-negative bacteria which is the causal agent of vibriosis in fishes and also effective against *Vibrio parahaemolyticus* (Austin *et al.*, 1982). Halquinol has significant antimycoplasmal activity being active against different species of mycoplasma, *viz: Mycoplasma synoviae, Mycoplasma gallisepticum, Mycoplasma agalactiae var bovis, Mycoplasma hyopneumoniae and Mycoplasma hyorhinis* (Cosgrove and Baines, 1978). Among protozoa, halquinol has good activity against *Cryptosporidium parvum* (Armson *et al.*, 1999). Thus keeps the gut healthy and active as a result more efficient absorption of nutrients through the intestine which ultimately improves the body weight, body weight gain, feed intake, and feed efficiency than the control group (T_0). Halquinol also prevents and controls many types of nonspecific diarrhea. Its unique anti-peristaltic activity promotes better absorption of nutrients. Kompiang *et al.*,(1997) reported that the effect of halquinol supplementation in the 20 and 30% cassapro rations on the performance of the chickens has a significant effect on feed intake ($P <0.025$), weight gain ($P < 0.0005$) and FCR ($P < 0.0005$). The feed intake of the birds fed 30% cassapro ration was lower than those of 20% cassapro. Kompiang (1983) also found a similar observation that halquinol has no effect on feed intake. Present study also revealed that dressing percentage, liver, heart and gizzard weight was not significantly ($p>0.05$) differed among the experimental birds. The dressing weight, breast meat weight, thigh meat weight, liver weight and shank weight were significantly differed among the experimental groups due to anti-peristaltic activity of Halquinol which promotes better absorption of nutrients that directly helps in their weight gain.

The recent study shows that the hematological parameter such as Hb, PCV and ESR value of the birds of different groups does not differ significantly among the groups and it was within the normal range. That indicates that supplementation of halquinol has no negative effect on the blood profile of Sonali chicken that means Sonali chicken was physically sound and healthy during the experimental period and experimented halquinol supplementation was safe for the Sonali chicken. But Swetha *et al.* (2009) found that, Halquinol was administered in rats orally by gavage at the dose 1000 (high) mg/kg body the Hb, TEC and MCHC decreased significantly ($P <0.01$) whereas MCV increased significantly ($P <0.01$) in high dose group. At the end of the experiment total production cost per birds was 93.31Tk.for control group (T_0), 94.54Tk.for the birds supplied with Halquinol 0.25g/ kg feed (T_1), 95.06 Tk. for the birds supplied with Halquinol 0.5g/ kg feed (T_2), and 95.76Tk. for the birds supplied with Halquinol 1g/ kg feed (T_3). Total profit per birds of Sonali chicken were highest in group T_3 (18.79Tk.), followed by group T_2 (12.24Tk.), T_1 (9.86Tk.) and the lowest in control group T_0 (3.84Tk.) Net profit over control was highest for the birds supplied with Halquinol 1g/ kg feed in group T_3 (14.95Tk.), followed by birds supplied with Halquinol 0.5g/ kg feed in group T_2 (8.40Tk.) and birds supplied with Halquinol 0.25g/ kg feed in group T_1 (6.02Tk.). It is therefore distinct that additional supplementation of Halquinol in feed is profitable over control group (T_0).

5. Conclusions

Based on the result of present study it may be concluded that Halquinol is a non-antibiotic antimicrobial growth promoting agent and it has significant effect on body weight gain and feed efficiency on Sonali chicken. So, the result of this study suggests that supplementation of Halquinol up to 1g/ kg feed can be used as a non-antibiotic antimicrobial growth promoting agent for the production of Sonali chicken. As use of this products are economically profitable and have no harmful effect on human health, commercial Sonali chicken farmers may use this inexpensive and efficient growth promoting agents on their Sonali chicken farm to earn more profit which would contribute to the economy of Bangladesh.

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Conflict of interest

None to declare

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