Bangladesh Journal of Veterinary and Animal Sciences
Journal home page: www.bjvas.com
pISSN 2227-6416
eISSN 2709-2542

Research article

Ascertaining the productivity and economic profitability of broiler chicken fed compound diet supplemented with herbal product

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A R T I C L E I N F O

Article history:

Received: 28/07/2021
Accepted: 23/02/2022

Keywords:

Growth, herbal supplement, cost-benefit, carcass traits, survivability, broiler chicken

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A B S T R A C T

The study was conducted to investigate the effects of herbal liver tonic (superliv) on the growth performance, meat yield, viability and cost benefit analyses of broiler from day-old to 28 days. The chicks were raised on the floor of an open-sided housing condition. Ready-made starter diet (crumble) was fed the birds up to 16 days after that, grower (pellet) diet was fed the broiler from d17 to 28 days. The water was treated with superliv at the rate of (1ml/L), (1.5 ml/L) and (2ml/L), in D_2, D_3 and D_4 groups, respectively, and supplied the birds *ad libitum*. The data revealed that feed intake (FI) and viability (%) of broilers were unaffected ($P>0.05$) between treatment on 28 days. Significantly highest body weight (BW) (1661.90 g/b) was found in the bird of superliv supplemented (D_2) group. Improved ($P<0.05$; $P<0.08$) FCR values were observed in the broilers fed on superliv supplemented (D_2) diet compared to others. The results of meat yield revealed that the percentage of blood, dressing , drumstick weight, liver weight, thigh weight, back weight, neck weight and wing weight of broiler chicken increased ($P<0.05$) by superliv supplemented diets on broiler. Higher net profit was observed in the birds fed supplemented diets than that of control group in this study. It can be concluded that superliv @ 1ml/liter of water was found to be better in regards to the growth performance, carcass traits and profitability of broiler production.

To cite this paper: *M.M. Alam, M. A. Hossain, S. Ghosh and S. Zaman, 2021. Ascertaining the productivity and economic profitability of broiler chicken fed compound diet supplemented with herbal product. Bangladesh Journal of Veterinary and Animal Sciences, 9(2):15-22.*

1. INTRODUCTION

The increase in demand for poultry meat has given momentum to use of synthetic compounds in a feed. The high cost of such compounds increases the cost of poultry feed. Recently the safety margins have been burning issues, and their uses are becoming restricted in many parts of the world. Therefore, there is a great interest in developing natural alternative supplements to maintain animal performance and well-being (Chattopadhyay, 2006). Feed additives are generally used to improve appetite, enhance production and also act as anti-stress agents. Narayanswami et al.(2003) observed that feed additives increase the efficiency of feed utilization, growth and improved survivability of broiler chicken. Herbal liver tonics supplemented in broiler diets could serve as an effective growth promoters, and could help to gain better weight in broiler chicks (Ramappa and Devegowda, 1975). The full benefits of the nutrients present in the diets cannot be achieved

without the addition of feed additives in the feed.

Broiler raising is a very promising industry across the globe. The rapid growth and quick return have made it much popular for the raising broiler chicken more enthusiastically by commercial integrators, farmers under comercial farming condition. The present farmers are not happy with the existing growth pattern of broiler chicken. For this reason, they always hungry for adopting innovative and alternative strategy or feed technology, with which they can achieve more improved growth of broiler chicken within a very short time by saving feed cost. As we know, feed is the major cost of poultry production. Profit margin goes up if rearing time and feed cost can be reduced. However, currently, there are many growth promoter available in the market to reduce feed cost and to enhance growth of broiler chicken tremendously, as well as to meet up the constantly growing demand for broiler growth and saving feed cost to an extent. Apart from synthetic growth promoters, herbal growth promoter is a new introduction in the poultry industry. This growth promoter are drawing attention of the farmers undoubtedly. Because, it has no side effect on human health as the antibiotics do. Application of antibiotics on the broiler is being discouraged by the scientists across the globe due to its residual effect on the health. Adil *et al*. (2010) reported that the uses of animal by-products and indiscriminate application of antibiotics in animal nutrition by EU have already been banned. So it could be assumed that broiler meat produced from herbal products might increase the consumer demand with a profitable poultry production, to meet up the huge protein gap of the consumer world. So it is deemed necessary to undertake such a research on broiler chicken with herbal liver tonic, which can help for building consumer awareness for having healthy, safe and sound food item. It could be assumed that application of herbal supplements on the broiler chickens, might enhance broiler production with cutting costs significantly. Poultry feed supplemented with herbal liver tonic (superliv) might improve the nutrient utilization by reducing the number of pathogenic microorganisms found in the gut of the birds. Supplementation of herbal tonic on broiler chicken might be economical, and it could reduce feed cost and enhance profitability. Further, it might enhance nutrient availability of bird and thus increase the productivity of broiler chickens. Data on herbal liver tonic are scarce, and it might induce further study to boost up the broiler production to an extent. Adequate data are not available regarding herbal products, so the present study was under-taken to investigate the productivity of broiler chickens fed herbal liver tonic (superliv).

2. MATERIALS AND METHODS

Animal husbandry and bird management

A total of 144 day-old broiler chick was procured from the local hatchery to run the experiment from day 01 to 28. Broiler chicks (n=144; Cobb500) were weighed on receipt, and later randomly distributed into four treatments (D_1 D_2, D_3, and D_4), each treatment replicated 4 times with 9 birds per replicate in a completely randomized design. The chicks were raised in the littered-floor of open-sided housing condition from d1-28 days. For the first 2 days, the chicks were brooded with a temperature of 33^{o}C. The temperature was then gradually reduced by 1 or 2^{o}C every 1 or 2 days until the chicks were 19 days old at which point the temperature was maintained at 24^{o}C for the rest of the trial. The chicks were exposed to a continuous lighting program entire the trial period. The chicks were allocated into 16 equal size pens, which were furnished with one feeder and one drinker. Wood shaving litter materials were spread on the surface of the each pen to a depth of 2.54 cm. Birds were vaccinated against Ranikhet and Gumboro diseases to increase the immunity of birds as per the instructions given by the manufacturing company.

Diet

Ready-made broiler feed (Paragon Feed Ltd.) was procured from the market and provided the chicks *ad libitum*, and the birds had a free access to water. The chicks were given starter diets (crumble) for the first 16 days, after that, grower diet (pellet) was fed the birds (Table 1). The water was mixed with herbal tonic (superlive, ACI Animal Health Ltd.) at the rate of 1ml/L, 1.5 ml/L and 2ml/L, in D_2, D_3 and D_4

groups, respectively, and supplied the birds *ad libitum*. The chemical compositions of the ready-made diet and superliv were given below in Tables (1, 2)

Table 1. Chemical composition of superliv liver tonic

Ingredients	**Amount**
Choline chloride	0.1 g
Sobitol solution	50 g
Herbal extracts.	1 liter

Data and sample collection

Mortality of bird was recorded as it occurred, while body weight and feed intake were recorded weekly for the calculation of body weight gain, and feed conversion ratio (FCR) was corrected for mortality. Livability was calculated from mortality of birds per replicate cage. On day 28, meat yield (dressed yield, breast weight, thigh weight, drumstick weight, shank weight, giblet weight) characteristics were recorded.

Statistical analysis

All recorded and calculated data were statistically analyzed for analysis of variance in a Completely Randomized Design (CRD) using the Minitab statistical computer package program (Minitab, 2000). The significance of differences between means was tested using the Duncan multiple range test. Statistical significance was considered at $P \leq 0.05$.

3. RESULTS

Gross responses of broiler fed herbal supplemented diets

The results of cumulative body weight (BW) and feed intake (FI) and feed conversion ratio (FCR) of broiler chickens are shown in Table 3. The data show that BW of broiler differed significantly ($P<0.05$) among treatments entire the trial period, except for the first week. Significantly highest BW (1661.90 g/b) was found in the bird fed D_2 diet whereas D_1 is the lowest BW (1302.20 g/b) from days1-28. The results of FI had no significant difference ($P>0.05$) between the treatment groups from days1-28. Numerically, birds on D_2 group consumed more feed than that of other diet group on day 28, though no difference ($P>0.05$) was observed between treatment. The feed intake (FI) of D_2 group is 2497.60g followed by 2434.10 g, 2415.90 g, and 2386.0g in D_3, D_1 and D_4, respectively, on the last day of the trial period (28). Data revealed that the FCR of broilers differed significantly ($P<0.05$) during 2nd and 3rd weeks only, except for 1st and last weeks. The FCR values observed in the broilers fed liquid superliv supplement during last and first weeks were tend to be significant ($P<0.08$). Improved FCR value (1.61) was observed in the D_2 group of broiler compared to those of other group.

Livability (%)

The data on livability are presented in Figure 1. It is evident that one bird died in D_1 and D_2 group resulting 97.22% livability, while two birds died in group D_4 resulting 94.44 % livability. Actually, no mortality was observed in the birds of D_3 group, which indicates 100% viability. In fact, the data of viability of broiler chickens revealed that there is no significant difference ($P>0.05$) between the treatments.

Carcass characteristics and meat yield (%) of broiler chickens fed on superliv

Carcass characteristics and meat yield parameters of broiler of different treatments are stated in the Table 4. The results of meat yields indicate that, except for gizzard and breast weight, all other characteristics such as, blood %, dressing %, liver weight(g), thigh weight (g),

Table 2. Nutrient concentration of ready -made diet (Paragon feed Ltd.) fed the broilers.

Type of feed	**Nutritional values (%)**											
	DM	**CP**	**EE**	**CF**	**Ash**	**NFE**	**Ca**	**P**	**Met**	**Lys**	**Tryp**	**Thre**
Starter diet	89.2	23.7	7.10	5.80	11.7	53.04	1.30	0.51	0.36	0.99	0.18	0.59
Grower diet	89.3	22.8	6.80	6.40	9.50	53.3	1.32	0.50	0.36	0.70	0.21	0.53

[Adapted from Roy et al., 2004.]

Table 3. Cumulative body weight (BW), feed intake (FI) and feed conversion ratio (FCR) of broiler chickens treated with superliv from day-old to 28 days.

	Age (day)	Treatment				Pooled SEM	P-values
		D_1	D_2	D_3	D_4		
BW(g/b)	1-7	159.89	198.97	197.83	173.08	6.410	0.136
	1-14	395.00^{c}	524.72^{a}	469.56^{b}	426.14^{c}	9.855	0.01
	1-21	865.50^{c}	1114.40^{a}	910.60^{b}	898.00^{b}	28.300	0.05
	1-28	1302.20^{c}	1661.90^{a}	1497.40^{a}	1386.20^{b}	41.550	0.05
FI (g/b)	1-7	161.67	185.83	187.36	169.17	5.320	0.289
	1-14	636.11	710.83	704.92	659.17	15.278	0.292
	1-21	1501.80	1720.80	1599.50	1594.90	34.000	0.211
	1-28	2415.90	2497.60	2434.10	2386.00	19.00	0.254
FCR	1-7	1.42	1.24	1.24	1.34	0.0254	0.081
	1-14	1.82^{a}	1.48^{c}	1.66^{b}	1.74^{a}	0.005	0.01
	1-21	1.83^{a}	1.61^{b}	1.87^{a}	1.88^{a}	0.029	0.05
	1-28	1.98	1.55	1.68	1.79	0.054	0.084

[Data represent mean values of nine birds per replicate groups during 1 to 28 days; ^{a,b,c}Means bearing uncommon superscripts within a column are significantly different at the levels shown above; D_1 refers to control group with no herbal products, whereas , D_2, D_3 and D_4 dietary groups were supplemented with 1ml/L, 1.5 ml/L and 2ml/L superliv, respectively; SEM= Pooled standard error of means].

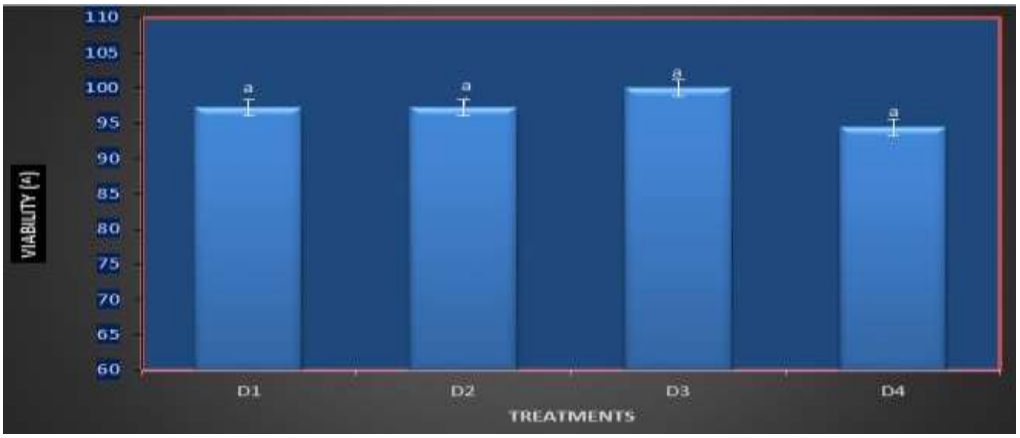

Figure 1. Viability of broiler chickens fed ready- made diets supplemented with growth promoter (superliev) from d1-d28; Bar with similar letter has no significant difference (P>0.05) between treatments

Table 4. Meat yield traits (g/b) of broiler treated with superliv on 28 day.

	Treatment				Pooled SEM	P-values
	D_1	D_2	D_3	D_4		
Blood (%)	4.92^{b}	5.62^{a}	5.15^{a}	4.31^{b}	0.139	0.05
Dressing (%)	61.32^{c}	65.78^{a}	66.00^{a}	63.49^{b}	0.552	0.05
Liver weight	40.00^{b}	48.50^{a}	48.25^{a}	39.50^{b}	0.892	0.01
Gizzard weight	17.25	20.00	18.75	16.75	0.569	0.22
Drumstick weight	104.75^{b}	136.50^{a}	128.00^{a}	113.75^{b}	2.023	0.01
Thigh weight	118.25^{b}	155.75^{a}	144.25^{a}	120.75^{b}	2.250	0.01
Breast weight	335.25	327.75	348.50	347.25	5.810	0.55
Wing weight	77.25^{b}	113.25^{a}	116.50^{a}	77.00^{b}	3.360	0.01
Neck weight	52.75^{b}	71.75^{a}	68.25^{a}	54.25^{b}	1.66	0.01
Back weight	134.50^{b}	179.75^{a}	163.75^{a}	137.00^{b}	3.00	0.01

[Data represent mean values of two birds per replicate groups consisting of nine birds during 28 days; ^{a,b}Means bearing uncommon superscripts within a row are significantly different at the levels shown above; SEM= Pooled standard error of means].

Table 5. Cost benefit analyses of broilers fed liver tonic on 28 day.

	Dietary treatment				Pooled SEM
	D_1	D_2	D_3	D_4	
Live weight (g/b) on d28	1302.20^{c}	$1.661.90^{a}$	1497.40^{b}	$1.386.20^{c}$	41.550^{*}
Feed cost (Tk/kg live weight)	80.68	65.39	70.72	74.88	-
Total production cost (Tk/kg live wt.)	113.49^{a}	108.0^{c}	107.90^{b}	111.53a	0.255**
Market price (Tk /kg live bird)	125.00	125.00	125.00	125.00	-
Profit (Tk/kg live bird)	11.51^{c}	17.00^{a}	17.10^{a}	13.47^{b}	0.149**

[Mean values bearing different superscript in a row differ significantly; ** = P<0.01; * = P<0.05]

wing weight (g), neck weight (g) , back weight (g) and drumstick weight (g) etc., measured here in this study, were significantly increased (P<0.05; P<0.01) between treatments (Table 4). No significant difference (P>0.05) was found in gizzard weight and breast weight of broiler chickens.

Cost-benefit analysis

The cost benefit of broiler demonstrates that bird on D_2 group had received the highest profit (P<0.01) and lowest production cost (Table 5). The economics of broiler production showed that net profit per bird was significantly higher for superliv supplemented group, showing the highest return (Tk./kg) in D_2 and D_3 followed by D_4 and control group, respectively . Control group (D_1) had very low profit 11.51 Tk. only. The highest return of broilers on supplemental group might be due to lower production cost and increased body weight gain, as is seen in this study.

4. DISCUSSION

Body weight of broiler

It is obvious from the data that the body weight in the superliv liquid supplemented group was found to be significantly improved as compared to control group throughout the experiment, in this study. The main function of feed additives is to enhance feed utilization efficiently. Once after applying in the broilers, the feed additives start to act upon their digestibility of the ingested nutrient materials, which are then helped the birds to utilize feed more efficiently. It can be assumed that the efficient utilization of feed by the broilers might give rise to better growth responses of the broiler chickens. The reason for improved growth and better utilization of birds might be due to the supplementation of Superliv, because it acts as a liver tonic which promotes several functions in the body such as stomachic, appetitive, demulcent, tonic activity anabolic etc. (Narahari, 1995; Prajapati, 1997). Our findings agreed with the results of previous investigators (Babu et al, 1992, Narahari, 1995, Prajapati, 1997, Samarsinghe *et al.*, 2002*)*, who found significant improvements in body weight due to supplementation of other herbal feed additives in broilers. The body weight gain in superliv liquid supplemented birds might be attributed to the growth promoting activity of its constituent herbs viz. *Andrographis paniculata, Azadirachta indica, Phyllanthus nirur I* (Jagadeeswaran and Selvasubramanian, 2014; Mathivanan et al., 2006; Durrani et al., 2008).

Feed intake

There is no difference between feed consumption of broiler chickens fed herbal supplemented superliv in our current study. It denotes that broilers consumed feed uniformly entire the trial period, as no significant differences are found in feed consumption of bird between treatments. The uniform feed intake of broilers on herbal growth promoter might be due to providing same diet and the mode of application of growth promoter to the birds. The herbal growth promoter was applied the birds via water, not with feed, as it is liquid in form. This mode of application of growth promoter might be a reason for similar feed intake by the broilers. Besides, all birds had a free access to same diet entire the trial period. It was observed that there were no adverse effects of the herbal liver tonic on feed consumption, palatability and thereby the performance of broiler birds. These findings are in accordance with the report of Bhattacharyya et al. (2015), who noticed non-significant influence with

superliv supplemented diets on the feed intake of broiler chicken.

FCR

The data of FCR value indicates that birds of D_2, D_3 and D_4 groups assumed to be more efficient in converting feed to meat than the broilers of D_1 group during the experimental period of days 01-7. It shows that the birds of D_2 group assume to be more efficient than that of others, as the broiler of this diet group (D_2) had received superior FCR value (1.63) than that of other diet groups. The results of the present study are in agreement with those reported by Hung et al. (1992). Use of herbal growth promoters improved feed conversion ratio and feed efficiency, because they have stomachic, appetitive, demulcent and tonic activity in addition to anabolic, adapto-genic, immune-stimulant and rejuvenative functions in the body (Narahari, 1995 and Prajapati, 1997). It shows that supplementation of superliv @1ml/liter water, improved feed utilization of commercial broiler birds, which could be beneficial to the farmers.

Survivability of broiler

It is clear from the survivability data that herbal growth promoter had no influence on the livability or mortality of birds. It implies that herbal growth promoter does not have any detrimental impact on the viability of broilers. So it can be applied in the birds without any doubt. Though numerically, the highest mortality was observed in treatment group D_4, which is considered the mortality was within the normal range. The numerical increased mortality in D_4 group might be due to ascitis. The patho-physiological changes observed in the postmortem examination of dead bird did not attribute to the dietary treatments.

Carcass yield traits of broiler

The data of carcass yield reported that, the most of the meat yield traits are improved significantly in this study. The increased meat yield might be an outcome of improved growth responses of the broilers, as is seen in the study. The birds of D_2 group seemed to be more efficient than those of others, as the birds of this group attained better growth and FCR. The result implies that desired meat cut can be obtained when an herbal growth promoter is applied in the broiler. The findings of the present study are in agreement with the reports of Bikas Debnath et al. (2014), who reported that the dressing percentage was significantly improved in Xlivpro premix supplemented in comparison to the untreated group. Further, Sharma et al. (2008) reported that superliv DS and xlivpro applied in broiler had higher dressed and eviscerated percentage, 3-6 % more edible meat yields as compared to control. Dressing percentage and percentage yield of carcass cuts, dependent upon rearing system, length of fattening period and broiler sex (Bogosavljevic-Boskovic et al., 2011).

Cost benefit

Cost-benefit analysis is a systematic approach to estimating the profitability to poultry farmers and efficacy of product supplementation in terms of net profit over the control group. This net profit of broiler enterprise might vary mainly due to many factors, which include feed cost, feed intake, boy weight gain, mortality, market prices of broiler, seed stock, ingredient and others necessary items required for rearing broilers, Furthermore, a farm's profitability could also vary due to selling its finished products in the market in various forms say live birds, dressed bird, cooked meat, deboned meat, various meat cuts and so on (Akter et al., 2020). Anyway, our current findings are in agreement with the report of previous researchers (Bhattacharyya et al., 2015; Singh et al., 2009; Bikas et al., 2014). They reported that better economic returns were gained when birds offered superliv supplemented diets. An increase in the net profit per bird in treatment group D_2, D_3 and D_4 with supplementation of superliv over the control group concluded that there was decreased cost of feed, thereby reduced cost of production, and ultimately it has increased net profit compared to control group.
However, the criteria by which the cost and benefit and performance of birds are evaluated (live weight, carcass yield, or cut-up part value, total production cost of per kg live weight) as well as the current feed costs and market meat prices, might affect feed cost or production cost in relation to its economic returns (Zhai et al., 2013; Corzo et al., 2005, 2010). Because feed

ingredient prices, meat prices and other costs required for the broiler production constantly change, it is necessary to continually re-evaluate the relationship between feed ingredient costs and subsequent chick cost, processing yield in order to maximize profits.

5. CONCLUSION

It can be concluded that broiler on D_2 group supplemented with superliv grew better than that of other group of birds in this study. It could be assumed from the result that liver tonic could reduce the negative effect of liver function of broiler, and thus could improve the growth performance, nutrient utilization, carcass traits of broiler production without showing any adverse effect on health.

ACKNOWLEDGEMENT

The authors are greatly acknowledged to the working facilities of CVASU, Chattogram for conducting the experiment.

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