

*Original Research***Efficacy of Herbal Liver Tonic (Superliv) in Improving Growth Performance, Nutrient Utilization, Carcass Traits and Economics of Broiler Chicken****M.V. Dhumal^{*}, M. G. Nikam, P. V. Nandedkar, S. B. Majee and Ravikanth Kotagiri¹**

College of Veterinary and Animal Science, Parbhani, Maharashtra Animal and Fishery Sciences University Nagpur, Maharashtra, INDIA

¹Director R& D, Ayurvet Limited Baddi, Himachal Pradesh, INDIA***Corresponding author:** dhumalmv@gmail.com

Rec. Date:	Sep 18, 2017 15:12
Accept Date:	Jan 18, 2018 01:48
DOI	10.5455/ijlr.20170918031255

Abstract

The investigation was carried out to evaluate the efficacy of herbal liver tonic (Superliv) in improving growth performance, nutrient utilization, carcass qualities and economics of broilers. The study was carried out on 375 one day-old commercial Vencobb⁴⁰⁰ broiler straight run chicks. The chicks were weighed and distributed randomly into three treatment groups viz. A, B and C with five replications of 25 chicks in each replicate. For treatment group A ration was prepared as per BIS (2007) and for treatment group B ration was formulated with reduced energy (2.5%) with supplementation of Superliv @ 500gm/tonne. Similarly, for treatment group C ration was formulated with reduced energy (5%) with supplementation of Superliv. @500gm/tonne. The findings with cumulative body weight gain, feed consumption, FCR and mortality for different treatments groups were found to be non-significant. There were non-significant differences among the treatment groups with respect to edible carcass yield, breast yield, heart, liver, gizzard, giblet weight. There were significant decrease in the values of SGOT and SGPT in Superliv supplemented groups at 42nd day. Significantly higher values for total serum protein and globulin at 42nd day for Superliv supplemented groups were noticed, however, the values for albumin for different groups were found to be non-significant. Significant improvement in the percent metabolizable energy and protein retention values in 2.5% energy reduction and supplementation of Superliv were recorded. An improvement in the percentage (%) retention of phosphorus was noticed in herbal liver tonic (Superliv) supplemented groups. It was concluded that Superliv @ 500 gm/tonne of feed was used efficiently for compensating the negative impact of decreased energy values in feed of broiler thereby improving the growth performance, nutrient utilization, carcass traits and economics of broiler production without any adverse effect on health of broilers.

Key words: Broiler Performance, Economics, Nutrient Utilization, Superliv (Superliv Concentrate Premix), Supplementation

How to cite: Dhumal, M., Nikam, M., Namdedkar, P., Majee, S., & Kotagiri, R. (2018). Efficacy of Herbal Liver Tonic (Superliv) in Improving Growth Performance, Nutrient Utilization, Carcass Traits and Economics of Broiler Chicken. *International Journal of Livestock Research*, 8(6), 266-278. doi: 10.5455/ijlr.20170918031255

Introduction

The increase in demand for poultry meat has given momentum to use of synthetic compounds in a feed. This high cost of such compounds increases the cost of poultry feed. In addition to this, recently the safety of such practices has been questioned and their use is becoming restricted in many parts of the World. Therefore there is a great renewed interest in developing natural alternative supplements to maintain animal performance and wellbeing (Chattopadhyay, 2006).

Nature has provided natural plants with methionine in dipeptide and oligopeptide forms in readily digestible composition. In poultry, besides other vital organs, liver is the one which plays major role in building the foundation for successful performance of birds for optimum productivity and maximum profitability. The functions of liver are numerous like metabolism, circulation, detoxification, excretion, defense and haemopoiesis. Efficient liver functioning ensures effective digestion of feed, assimilation of nutrients, detoxification of metabolic, dietary, synthetic drugs (anthelmintic, antibiotic) linked toxins and also minimization of damaging effects of mycotoxins. Superliv premix is a polyherbal formulation of potent and highly efficacious pre-standardized and tested herbs. These herbs by virtue of their therapeutic action, for example, liver cell rejuvenating (hepatogenerative), hepato-stimulative, hepato-protective, anti-hepatotoxic and positive anabolic effect, tone up the liver of poultry birds for optimum performance and productivity, so that they can reach better growth and performance potential. Superliv is a liver formula for better protection and production. It has also, anti-oxidant and immunomodulatory properties. Superliv is herbal premix available in market. In this perspective, a study was conducted to evaluate the efficacy of herbal Superliv (Superliv Concentrate Premix, supplied by M/S Ayurved Limited, Baddi, HP, India) in commercial broiler chicken by reducing energy level by 2.5% and 5% in the diet.

Materials and Methods

Experimental Site

The experiment was carried out at the Broiler Unit of Department of Poultry Science, College of Veterinary and Animal Sciences, (Maharashtra Animal and Fishery Sciences University), Parbhani (Maharashtra), India.

Management of Experimental Birds

The experiment was carried out on (N=375) one day old commercial straight run broilers (Vencob⁴⁰⁰), from Venkateshwara Hatcheries Pvt. Ltd. Pune for a period of 42 days (6 weeks) from 28/12/2016 to

10/02/2017 at Broiler Unit, Department of Poultry Science, College of Veterinary and Animal Sciences, MAFSU, Parbhani. On arrival the chicks were weighed and distributed randomly into 3 treatment groups viz. A, B and C with five replicates of 25 chicks each and 125 birds per treatment. The birds were reared on deep litter housing system provided with an area of 1sq.ft./bird. The feed ingredients used in the present experiment were purchased from local market.

Table 1: Experimental design used for housing of broiler chicken supplemented with Superliv

Treatment Groups	Treatment Group Details	No. of Birds/Pen/Replication	No. of Replication	Total Birds
A	Control basal diet as per BIS (2007) (normal level of energy without supplementation of superliv)	25	5	125
B	Basal Diet with reduced ME 2.5% with supplementation of superliv @ 500gm/tonne	25	5	125
C	Basal Diet with reduced ME 5% with supplementation of superliv @ 500gm/tonne	25	5	125
Total number of birds				375

Ingredients and Formulation of Experimental Rations

For treatment group A, rations were prepared as per BIS (2007) and treatment B ration, was formulated with reduced energy (2.5%) with supplementation of Superliv @ 500gm/tonne. For Treatment group C, the rations were prepared with reduced energy (5%) and supplementation of the Superliv @ 500gm/tonne (Table 1). The feed was prepared at Feed Mixing Plant, College of Veterinary and Animal Sciences, MAFSU, Parbhani. The diet composition and nutritional levels in the feed during pre-starter, starter and finisher are presented in Table 2. The pre-starter ration was offered for first eight days, starter ration was offered from 9th day up to end of 21st day of age and finisher ration was offered thereafter up to 42nd day of age. The cost of rearing the chicks for complete experiment was calculated by taking into consideration the cost of chick, cost of total feed consumed by bird, cost of litter, vaccination and medication expenses.

Data Collection and Parameters

The cumulative weight gain, feed consumption, FCR and mortality were recorded replicate-wise at weekly interval and from these data the average weekly weight gains per bird, feed consumption, FCR and mortality were calculated for various treatment groups. After 42 days of the experimental trial, ten representative birds from each treatment group were randomly selected and slaughtered to study various slaughter traits.

Table 2: Percent ingredient compositions of Pre-starter, starter and finisher rations supplemented with Superliv

Feed Ingredients	PS standard + energy reduction + Superliv Premix			Starter + energy reduction + Superliv Premix			Finisher + energy reduction + Superliv Premix		
	PS SD	PS-2.5% (97.51)	PS-5% (95.02%)	S SD	S-2.5% (97.79%)	S -5%	F SD	F 2.50%	F 5% (95%)
Maize	47	47	47	55.26	55.26	55.26	63.26	63.26	63.26
Rice grain	4.26	4.26	4.26	0	0	0	0	0	0
Veg. oil;	5	4.06	3.12	5	4.04	3.08	5	4.01	3.01
Soya- DOC	32	32	32	28	28	28	26	26	26
Toasted guar meal	8	8	8	8	8	8	2	2	2
DCP	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
LSP	1	1.94	2.88	1	1.96	2.92	1	1.99	1.99
Salt	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Additives / supplements (gm/100kg)									
Mineral mixture	300	300	300	300	300	300	300	300	300
Vitamin mixture	150	150	150	150	150	150	150	150	150
D L-M	200	200	200	200	200	200	200	200	200
Superliv Premix/	0	50	50	0	50	50	0	50	50
Lysine	170	170	170	170	170	170	170	170	170
Choline chloride	60	60	60	60	60	60	60	60	60
Coccistat.	60	60	60	60	60	60	60	60	60
Total	100	100	100	100	100	100	100	100	100
C. Protein	22.81	22.81	22.81	21.41	21.41	21.41	18.35	18.35	18.35
Meta.energy	3018.04	2942.8	2867.6	3075.2	2998.4	2921.6	3181.2	3102	3022
E:P ratio	133.31:1	129.01:1	125.71:1	143.63:1	140.04:1	136.46:1	173.36:1	169.04:1	164.68:1
Feed cost/kg)	K27.87	26.88 (96.47%)	26.36 (94.58%)	24.29	23.75 (97.79%)	23.21 (95.57%)	21.89	21.33 (97.47%)	20.77 (94.91%)

(PS= Pre starter diet, S = Starter diet, F = Finisher diet, SD = standard ration meta. = Metabolizable); *Superliv was added to feed as per experimental plan shown in treatment details Characteristics of the product used Name : Superliv; Description: Herbal ingredients rich in free and conjugated form; Producer : M/S Ayurvet Limited, Baddi, HP, India

Blood samples were taken from 3 birds per pen (15 birds per treatment) at 21st day and 42nd day of trial, and sent to the Central Instrumentation and Analytical Facility, COVAS, Parbhani for analysis of following biochemical parameters using biochemical auto analyzer (ERBA Chem7). Total serum protein in each sample was determined with the help of UV visible Spectrometer as per the method described in diagnostic kit (Keller, 1991). The plasma AST and ALT were measured as per the method suggested by Schlebusch *et al.* (1974) as described in diagnostic Kit with the help of Microlab 200. A metabolic trial was carried out at the end of experimentation, for nutrients utilization. Five representative birds from each group were housed individually in the metabolic cages. Laboratory analysis of offered feed and excreta voided were done to estimate various parameters like utilization of percent metabolized energy, crude protein, calcium and phosphorus utilization. The cost of rearing the chicks for complete experiment was calculated by taking into consideration the cost of chick, cost of total feed consumed by bird, cost of litter

material, vaccination, medication expenses etc. The data collected were subjected to statistical analysis by using Factorial Randomized Block Design (Snedecor and Cochran, 2002). The treatment means were compared by critical differences (CD) and analysis of variance (ANOVA).

Results and Discussion

Cumulative Gain in Weight

An average means for the weekly cumulative weight gain of broiler chickens at different age groups are presented in Table 3.

Table 3: Cumulative gain in weight, feed consumption (gm) per bird of broilers at different age groups supplemented with Superliv

Treatment group	Parameter	Cumulative Gain in Weight						Cumulative Feed Consumption					
	Age	1 st	2 nd	3 rd	4 th	5 th	6 th	1 st	2 nd	3 rd	4 th	5 th	6 th
A		79.54	253.2 ^a	586.7 ^a	1086.8 ^a	1620.4 ^a	2160.1	103.48	387.0 ^a	849.1 ^a	1637.6 ^a	2626.81 ^a	3724.6
B		72.22	233.65 ^b	565.6 ^b	1044.1 ^b	1572.2 ^b	2137.3	102.68	382.5 ^a	842.0 ^a	1636.8 ^a	2614.17 ^a	3669.4
C		70.84	236.9 ^b	526.5 ^c	968.3 ^c	1488.7 ^c	2121.1	99.36	304.9 ^b	678.3 ^b	1448.5 ^b	2459.08 ^b	3644
SE		1.91	7.4	7.9	12.74	20.8	38.2	1.56	16.9	42.89	46.54	48.03	50.8
CD		134.28	16.56	17.77	28.48	46.6	85.5	3.5	37.9	95.91	104.06	107.4	113.8

The analysis of variance for the mean weekly cumulative body weight gain at 2nd, 3rd, 4th and 5th weeks showed significant differences among the treatment groups. Non-significant influence of Superliv on cumulative body weight gain was observed for 1st and 6th week. The critical observation of data indicated that *sub-optimal* treatment groups supplemented with Superliv were compensated the body weight to that of control group at 6th week of age. Non-significant influence of Superliv on cumulative body weight gain at 6th week are in contrast to the finding reported by Singh *et al.* (2009), Bikas *et al.* (2014) and Bhattacharyya *et al.* (2015), they revealed significant influence of herbal liver tonic on body weight gain, but in their study normal energy level diet was considered. It inferred that addition of Superliv in 2.5% and 5% *sub-optimal* diet resulted into compensation of cumulative gain in weight confirming efficacy of Superliv at par with that of control group.

Cumulative Feed Consumption

An average means for the cumulative feed consumption of broiler chickens at different age groups are presented in Table 3. The analysis of variance for the mean cumulative feed consumption at different week, showed significant differences ($P < 0.05$) from 2nd to 5th week, however the differences were non-significant in 6th week (Table 3). The significantly higher cumulative feed consumption (3724.64g) was recorded for Treatment group A, followed by Treatment group B, and C. Significantly low feed consumption was reported for Superliv supplemented with 5% *sub-optimal* diet in early phase, however,

in 6th week the differences were found to be non-significant. It was revealed that there were no adverse effects of the herbal liver tonic on feed consumption, palatability and thereby performance of broiler birds. These findings are in accordance with reports of Bhattacharyya *et al.* (2015) who noticed non-significant influence with Superliv supplemented diets.

Cumulative Feed Conversion Ratio

The mean cumulative feed conversion ratio of broilers for different age groups has been presented in Table 4.

Table 4: Cumulative FCR and Mortality of broilers at different age groups supplemented with Superliv

Treatment	Cumulative FCR at different weeks and overall mortality						Mortality (%)
Age	1 st	2 nd	3 rd	4 th	5 th	6 th	
A	1.3	1.52	1.44	1.5	1.62	1.69	5
B	1.42	1.63	1.48	1.56	1.66	1.72	2.5
C	1.4	1.31	1.29	1.49	1.65	1.72	3.75
SE	0.03	0.1	0.08	0.05	0.03	0.03	
CD	0.06	0.22	0.19	0.11	0.09	0.07	

The mean weekly feed conversion ratio (1.72) up to 6th week for Superliv treatment groups are similar to that of control, indicated that supplementation of herbal liver tonic compensated FCR to that of control group. The analysis of variance showed non significant differences among the treatment groups, may be due to more release and balancing of energy by more activity of liver, thereby compensating the performance of birds. The feed conversion ratios of broiler for Superliv supplemented groups were similar to that of control group. These results are contrary to the findings of Singh *et al.* (2009), Bikas *et al.* (2014) and Bhattacharyya *et al.* (2015) as they carried out the experimentation with normal energy diets. The results of present study are in concomitance 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 was concluded that supplementation of Superliv @0.05 gm/kg of feed, improved feed utilization of commercial broiler birds which is beneficial to the farmers.

Mortality

The mortality percent in the various treatment groups is presented in Table 4. The highest mortality was observed in treatment group A. However, the mortality was within normal range in different groups. Numerical increase in the mortality in treatment group A may be due to ascites. The patho-physiological changes observed under postmortem examination of dead bird did not attribute to the dietary treatments.

It indicated that dietary supplementation of herbal tonic (Superliv) had no detrimental effect on survivability.

Carcass Traits

Edible Carcass Yield

An average mean for the edible carcass yield of broilers for different age groups at 42nd day are presented in Table 5. The analysis of variance showed non-significant differences among the treatment groups (Table 6). The non-significant differences among the treatment groups concluded that edible carcass yield produced by Superliv @ 0.05% are similar to that of control group without affecting the carcass yield.

Table 5: Carcass yield (%), breast yield (%), heart weight (gm) and liver weight (gm) of broilers in different groups supplemented with Superliv

Treatments Group	Carcass yield (%)		Breast yield (%)		Heart weight (gm)		Liver weight (gm)	
	Mean	±SE	Mean	±SE	Mean	±SE	Mean	±SE
A	72.85	3.25	31.21	2.59	1.35	0.10	3.43	0.69
B	71.71	5.01	25.26	1.17	1.16	0.28	3.17	0.14
C	64.86	0.54	30.80	1.49	1.48	0.09	3.48	0.66

Table 6: Analysis of variance for carcass yields (%), breast yields (%), heart weights (gm) and liver weights (gm) of broilers supplemented with Superliv

Source	DF	Carcass yield (%)		Breast yield (%)		Heart weight (gm)		Liver weight (gm)	
		MSS	'F' value	MSS	'F' value	MSS	'F' value	MSS	'F' value
Treatment	2	93.24	1.56	81.37	0.70	2.6	0.13	102.60	0.50
Weeks	12	59.83	---	116.40	---	20.77	---	205.76	---

Breast Yield

An average mean for the percentage of breast yield of broilers for different age groups at 42nd day are presented in Table 5. The analysis of variance (Table 6) revealed low breast yield for Treatment group B, however, the differences were non-significant. The findings in the present study are in agreement with reports of Singh *et al.* (2009), Bikas *et al.* (2014) and Bhattacharyya *et al.* (2015), they reported that there were no significant differences in the percent dressing yield.

Heart and Liver Weight

An average mean for heart and liver weight of broilers for different age groups at 42nd day are presented in Table 5. The analysis of variance (Table 6) revealed non-significant differences in Heart and liver weights. It clearly inferred that there was no any adverse effect of herbal liver tonic (Superliv) on health of birds and it ensures effective metabolism, circulation, detoxification and excretion.

Gizzard and Giblet Weight

An average means for Gizzard and Giblet weight of broilers for different age groups at 42nd day are presented in Table 7. The analysis of variance (Table 8) revealed non-significant differences in Gizzard and Giblet weight. It inferred that there was no any adverse effect of herbal liver tonic on health of birds and it ensures effective metabolism, circulation, detoxification and excretion.

Table 7: Gizzard and giblet weight in broilers supplemented with herbal Superliv

Treatments	Traits			
	Gizzard Weight (gm)		Giblet Weight (gm)	
	Mean	±SE	Mean	±SE
A	2.87	0.21	7.54	0.96
B	2.80	0.42	7.14	0.57
C	3.06	0.28	8.03	0.70

Table 8: Analysis of variance for gizzard and giblet weight of broilers supplemented with herbal superliv

Source	DF	Gizzard weight (gm)		Giblet weight(gm)	
		MSS	'F' value	MSS	'F' value
Treatment	02	80.00	1.09	372.20	0.98
Replicate	12	73.03	---	383.00	---

SGOT and SGPT

The mean serum values for SGOT and SGPT for different age groups at 21st day and 42nd day are presented in Table 9.

Table 9: SGOT and SGPT levels at different age of broilers supplemented with Superliv

Treatments Group	SGOT (u/l)				SGPT (u/l)			
	21 st day		42 nd day		21 st day		42 nd day	
	Mean	±SE	Mean	±SE	Mean	±SE	Mean	±SE
A	29.31	3.30	98.46	13.56	10.02	1.39	13.73	0.69
B	44.18	3.30	59.06	13.56	12.23	1.39	12.57	0.69
C	41.89	3.30	49.62	13.56	11.09	1.39	10.59	0.69

The analysis of variance (Table 10) showed significant decreased values for SGOT and SGPT for Superliv supplemented groups at 42nd day except SGOT value at 21st day. This indicated Superliv efficacy or property of hepato-protective and liver tonic, it protected the liver from any damage thereby did not cause any liver dystrophy or other vital organ abnormality where from these enzymes are secreted. This was also witness that all the birds were apparently in healthy condition throughout the experimental period (Prabhakaran *et al.*, 1996). These findings are in accordance with the reports of Bikas *et al.* (2014) and Akbarian *et al.* (2012), who have collected data in broiler chickens, showed no significant differences in the activities of AST, ALT and LDH enzymes on supplementation of herbs. It was concluded that Superliv facilitated efficient lipid metabolism without causing any liver dysfunction in broiler.

Table 10: Analysis of variance for SGOT and SGPT levels of broilers supplemented with Superliv

Source	DF	SGOT (u/l)				SGPT(u/l)			
		21 st day		42 nd day		21 st day		42 nd day	
		MSS	'F' value	MSS	'F' value	MSS	'F' value	MSS	'F' value
Treatment	2	961.25	5.88**	10067.04	3.650*	18.42	0.636	37.88	5.27**
Weeks	42	161.41	---	2758.02	---	28.99	---	7.188	---

Total Serum Protein (gm %) and Albumin (gm %)

The mean serum values for total serum protein (gm %) and albumin (gm %) for different age groups at 21st day and 42nd day are presented in Table 11.

Table 11: Total serum protein (gm %), albumin (gm %) and globulin levels at different age of broilers supplemented with Superliv

Treatment Group	Total serum protein (gm%)				Albumin (gm%)				Globulin (gm%)			
	21 st day		42 nd day		21 st day		42 nd day		21 st day		42 nd day	
	Mean	±SE	Mean	±SE	Mean	±SE	Mean	±SE	Mean	±SE	Mean	±SE
A	4.18	0.2	3.44 ^a	0.46	1.65	0.17	1.78	0.08	2.57	0.16	1.65	0.47
B	4.83	0.2	6.70 ^c	0.46	1.82	0.17	1.72	0.08	3.14	0.16	4.98	0.47
C	4.98	0.2	5.69 ^d	0.46	1.52	0.17	1.97	0.08	3.46	0.16	3.72	0.47

The analysis of variance (Table 12) showed significant increased values for total serum protein at 42nd day for Superliv supplemented groups.

Table 12: Analysis of variance for total serum protein (gm %), Albumin (gm %) and Globulin levels of broilers supplemented with Superliv

Source	DF	SGOT (u/l)				SGPT(u/l)				Globulin (gm%)			
		21day		42 day		21day		42 Day		21 st Day		42 nd day	
		MSS	'F' value	MSS	'F' value	MSS	'F' value	MSS	'F' value	MSS	'F' value	MSS	'F' value
Treatment	2	2.71	4.31	41.84	12.72**	0.34	0.76	0.26	2.714	2.99	2.93	42.28	12.73**
Replicate	42	0.63	-----	3.29	---	0.44	---	0.09	---	1.02		3.32	

However, non- significant differences were observed at 21st day. The values for albumin (gm %) for different groups at 21st day and 42nd day were non-significant. Significant increase in the values of total serum protein at 42nd day for Superliv supplemented groups clearly indicated the effective functioning of liver. Similarly, non-significant influence revealed that the level of herbal Superliv did not have any effect on serum total albumin. In contrast to presented study, Bikas *et al.* (2014) reported that plasma concentrations of total protein (gm/dl) between both groups on day 21st and on day 42nd varies non significantly ($P>0.05$).

Globulin (gm %)

The mean serum values for Globulin (gm %) for different age groups at 21st day and 42nd day are presented in Table 11. The analysis of variance (Table 12) showed significant increase in globulin values

for Superliv supplemented groups (B & C) at 42nd day. However, the differences were non-significant at 21st days. The significant effect increase in globulin values in Superliv supplemented groups 42nd day may be due to increase values of total serum protein. It inferred the effective functioning of liver for metabolism of protein.

Percent Metabolizable Energy and Protein Retention

The mean percent metabolizable energy protein retention values (42nd day) are presented in Table 13. The analysis of variance showed significant ($P < 0.05$) increased values for treatment group B at 42nd day for energy and protein. Significant improvement in the percent metabolizable energy and protein retention in 2.5 % energy reduction and supplementation of superliv 500 gm/tonne indicated efficacy of herbal liver tonic (Superliv con.). The findings of Singh *et al.* (2009) are in accordance to present findings. They revealed that increase in the metabolizable energy, crude protein retention values indicate efficacy of herbal liver tonic product Superliv. The results in the present are similar to those of Ali *et al.* (1994). They observed higher feed efficiency in terms of energy retention in Livol fed broilers.

Table 13: Percent metabolizable energy and protein retention in broilers supplemented with herbal Superliv

Treatment	Percent Metabolizable Energy Retention	Percent Retention Protein
A	75.88 ^b	69.25 ^b
B	78.90 ^a	72.27 ^a
C	71.39 ^c	67.30 ^c
SEM	0.61	0.86
P-value	0.00	0.00

Values bearing different superscripts within a column are significantly ($P < 0.05$) different

Percent Phosphorus and Calcium Retention

The mean percent metabolizable phosphorus and calcium retention values at 42nd day are presented in Table 14.

Table 14: Percent phosphorus and calcium retention in broilers supplemented with herbal Superliv

Treatments	Percent Phosphorus Retention		Percent Calcium Retention	
	Mean	±SE	Mean	±SE
A	46.73 ^a	3.67	45.89 ^a	5.26
B	29.53 ^b	3.67	24.60 ^b	5.26
C	47.98 ^a	3.67	36.43 ^a	5.26

The analysis of variance (Table 15) showed significant ($P < 0.01$) decreased values for Treatment Group B at 42nd day for Superliv supplemented Treatment Groups. However, non-significant ($P < 0.05$) decreased values for calcium was observed. There was a significant ($P < 0.01$) improvement in the percentage (%) retention of phosphorus. However, there were no differences in control and treatment C for phosphorus

and calcium retention values indicated no any adverse effect of herbal liver tonic product (Superliv) on phosphorus and calcium utilization.

Table 15: Analysis of variance for phosphorus and calcium retention in broilers supplemented with herbal Superliv

Source	DF	Percent Phosphorus Retention		Percent Calcium Retention	
		MSS	'F' value	MSS	'F' value
Treatment	02	1021.86	7.55**	1138.08	4.13*
Replicate	01	6.41	0.05	156.82	---
Error	26	135.35	-----	276.74	---

Economics of Broiler Production

The economics of broiler production (Table 16) showed that net profit per bird was significantly higher for Superliv supplemented groups, showing the highest return (Rs) in treatment group C (57.29) followed by treatment group B (55.78), treatment group A (53.97).

Table 16: Economics of broiler production supplemented with Superliv

S. No.	Particulars	A	B	C
1	Cost of day old chick (Rs)	38	38	38
2	Feed consumption (gm)			
i)	Pre-starter	201.2	202.2	199.3
ii)	Starter	1050	1049	1052
ii)	Finisher	2473.44	2418.23	2392.73
	Total	3724.64	3669.43	3644.03
3	Rate of feed (Rs/kg)			
i)	Pre-starter	27.87	26.88	26.36
ii)	Starter	24.29	23.75	23.21
iii)	Finisher	21.89	21.33	20.77
4	Cost of feed consumed (per bird Rs.)			
i)	Pre-starter	5.6	5.42	5.24
ii)	Starter	25.5	24.91	24.41
iii)	Finisher	54.13	51.57	49.68
	Total cost of feed consumed per bird (Rs.)	85.23	81.9	79.33
5	Miscellaneous cost* (Rs)	6	6	6
6	Total cost of production (1+4+5)	91.23	87.9	85.33
7	Average live weight (gm)	2200.4	2177.28	2161.3
8	Return obtained @ Rs. 76 per kg live weight	145.2	143.68	142.62
9	Net profit/ bird (Rs)	53.97	55.78	57.29
10	Net profit/ kg LW(Rs)	24.53	25.62	26.51

*Miscellaneous cost includes cost of medicines, vaccines, litter and other expenses including the cost of Superliv

This variation occurred mainly due to variation in feed cost, feed intake, weight gain and mortality. The findings are in agreement with by Singh *et al.* (2009), Bikas *et al.* (2014) and Bhattacharyya *et al.* (2015). They reported that Superliv supplementation gave better economic returns. An increase in the net profit per bird in treatment group B (3.35%) and C (6.15%) with supplementation of Superliv over control

group with reduced energy level concluded that there was decreased cost of feed, thereby reduced cost of production and ultimately it has increased net profit compared to control group.

Conclusion

On the basis of all the findings, it can be concluded that supplementation of liver tonic product Superliv (supplied by Ayurved limited Baddi, India) is efficacious for improving growth, performance and economic returns in broilers besides normalizing biochemical parameters. It indicated the property of hepatoprotective and liver tonic, it protected the liver from any damage thereby did not cause any liver dystrophy or other vital organ abnormality where from these enzymes are secreted. The product was found to be safe for usage and can be recommended as liver tonic and growth enhancer in poultry. From metabolic trial, revealed that Percent energy, protein and calcium, phosphorus retention were significant to highly significant in Superliv supplemented compared to that of control concluding that supplementation of Superliv @500gm/tonne of feed is beneficial for optimum feed utilization.

Acknowledgement

The authors are thankful to Dr. (Mrs.) S.B. Majee, Associate Dean, College of Veterinary and Animal Sciences, MAFSU, Parbhani for providing infrastructure facilities. The authors are also thankful to M/S Ayurved Limited, Baddi, HP, India for sponsoring the research trial and Superliv Concentrate Premix sample.

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