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Original Research Article

Effect of Supplementation of Feed Additives in Diet on Growth Performance of Broiler Chicken

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A B S T R A C T

An experiment was conducted with 200 day-old broiler chicks to study the effect of supplementation of vitamin, mineral and probiotic in diet on their performance. The chicks were randomly divided in to 8 groups containing 25 chicks in each group as following treatments: T_1 (control group), T_2 (Supplivit), T_3 (Agrimin), T_4 (Biovet - YC), T_5 (Supplivit + Agrimin), T_6 (Agrimin + Biovet- YC), T_7 (Supplivit + Biovet- YC) and T_8 (Supplivit + Agrimin + Biovet- YC). Chicks fed diet without vitamin, mineral, probiotic and their combination (T_1) reflected significantly lower body weight than all supplemented groups (T_2, T_3, T_4, T_5, T_6, T_7 and T_8). The overall results of body weight gains indicated that the ration in which combination of vitamin, mineral and probiotic were supplemented (T_8) showed improvement in body in body weight gain significantly ($P<0.05$) than that diet without any supplemented (T_1) during experimental period. Feed intake at different weekly intervals as influenced by dietary inclusion of vitamin, mineral and probiotic revealed that this trait was not statistically different among different treatments except in third and fourth week of age. There was no significant difference in feed conversion ratio (FCR) value in the chicks fed supplemented diet during the second, third, fourth and six week of age in treatments groups. Based on the result obtained in the present study, it can be concluded that by using non-antibiotic feed additive particularly mixing of all vitamin, mineral and probiotic at recommended dose have the potential to be applied as effective substitute for getting good economical return in the broiler farming.

Keywords

Broiler, probiotics, mineral, vitamin, weight gain, feed intake, FCR

Introduction

Poultry is one of the fastest growing segments among the component of livestock sector in India. Production of agricultural crops has been growing at a rate of 1.5-2.0% per annum while poultry industry is growing at 8-15% per annum in India. The organized sector of the poultry is contributing nearly 70% of the total output and the rest 30% by the unorganized sector. About 66.7% of the total output from poultry is realized from the poultry meat sector and only 33.3% from egg production. Feed is a major input which accounts 75% of the production cost in broiler economics (Saiyed *et al.*, 2015). Hence, it is imperative to give due attention to proper utilization of feed without adversely affecting the growth or production performance of broilers (Kokje, 1999). The margin of profit from broiler is reducing due to continuous increase in cost of quality poultry feed ingredients, therefore different types of commercial growth promoter have been tried to enhance the weight gain and to improve feed conversion efficiency.

Materials and Methods

Two hundred (200) day-old broiler chicks were procured and reared at Instructional Livestock Farm Centre of Bihar Veterinary College, Patna. Chicks were weighed individually, numbered with aluminium wing band and divided randomly into eight treatment groups having 25 chicks in each viz. T_1 (Control), T_2 (Supplivit premix (Vitamin) @ 25 g/quintal of feed), T_3 (Agrimin (Mineral) @ 1kg/quintal of feed), T_4 (Biovet-YC (Probiotic) @ 50 g/quintal of feed), T_5 (Supplivit premix @ 25 g + Agrimin @ 1 kg per quintal of feed), T_6 (Agrimin @ 1 kg + Biovet- YC @50 g per quintal of feed), T_7 (Supplivit premix @ 25 g + Biovet-YC 50 g per quintal of feed) and T_8 (Supplivit premix @ 25 g + Agrimin @ 1 kg and Biovet-YC @ 50g per quintal of feed). The standard management conditions and vaccination schedule were followed for all the birds maintained under deep litter system of management. The experimental data pertaining to different traits such as body weight at weekly interval and daily feed consumption were recorded. The experimental data obtained during the study with respect to different parameters were subjected to statistical analysis in completely randomized design (CRD) with simple analysis of variance (ANOVA) technique following the procedure of Snedecor and Cochran (2004).

Results and Discussion

Body Weight Gain

The results of experiment on average body weight gain of broiler chicken at weekly interval as influenced by addition of vitamins, minerals and probiotics is given in Table-1. The body weight gain during first week of growth was not significantly influenced by vitamin, mineral and probiotic supplementation, either singly or other combinations with each other. The average body weight gain ranged from 77.36±1.72 g. to 77.85±2.21g during first week of growth. There was not any significant ($P<0.05$) effect of vitamin, mineral and probiotic supplementation on body weight gain during the second week of age. The body weight gain during third week of age was significantly ($P<0.05$) influenced by dietary treatments. The maximum body weight gain was observed in T_8 group supplemented with a combination of vitamins, minerals and probiotic (360.61±1.99 g). The difference of this group (T_8), however, was not significant from the other supplementation groups. While the body weight gain of control group was significantly lower from T_8 group ($P<0.05$) but statistically similar to other supplementation groups. Chicks fed diet without supplementation reflected numerically lower body weight gain than all supplemented groups.

Results indicated that vitamins, minerals, probiotics and their combination supplementation could produce beneficial effect in weight gain during this phase of growth. During fourth week of age, maximum body weight gain 382.76 g was recorded in combination of vitamin and mineral incorporated group (T_5) which was significantly higher ($P<0.05$) from all other groups. The average body weight gain during fourth week of experimentation ranged from 299.47±1.72 g to 382.76±1.80 g and was significantly ($P<0.05$) influenced by dietary treatments. The vitamin, mineral, probiotic and their combination supplemented groups in general showed significantly ($P<0.05$) higher body weight gains than the control group (T_1) during fifth week of age. Among groups, combination of vitamin and mineral group (T_5) showed higher body weight gain than the chicks fed

with their supplemented combination group. The average body weight gain during this period were ranged from 332.83±1.61 g to 391.72±1.54 g and was significant (P<0.05) influenced by dietary treatments. The patterns of improvement in weight gain of chicks were almost similar as was observed in fifth week of growth. The vitamin, mineral and probiotic and their combination supplemented groups in general showed significantly (P<0.05) higher body weight gains than the control group (T_1). Among supplemented groups, combination of vitamin, mineral and probiotic incorporated group (T_8) showed the higher body weight gain than the chicks fed with vitamin, mineral and probiotic supplemented groups.

Further, the overall results of body weight gains indicated that the ration in which vitamin, mineral and probiotic combination was supplemented (T_8) showed improvement in body weight gain significantly (P<0.05) than the diet with vitamin supplementation (T_2) during third, fourth and sixth week of age only during experimental period. The results of present study in respect of probiotic are also in accordance with the findings of Maiorka *et al.,* (2002) and Pervez and Sajid (2011) who reported that supplementation of feed additives resulted in improvement in body weight gain of broiler chicks as compared to those fed on basal diet only.

This action might be due to live micro-organisms mainly lactic acid bacteria and spore forming organisms present in gastrointestinal tract of broiler chicken, minerals, vitamins and its synergistic effect which help in the establishment of intestinal microbial population which are beneficial for the proper growth in broiler chicken. However, the present findings did not agree with the findings of Iyayi and Davies (2005), Pierce *et al.,* (2006) and Abdelrahrman (2013) who reported that supplementation of probiotic did not show effect on body weight gain in broiler chicken. The differences in the results might be due to differences in the strain of probiotic, dose of probiotic, type of chicks used in the experiment and the environmental factors. Similar results in respect of use of feed additives and probiotics on body weight gain in poultry also have been reported by various workers Asmita *et al.,* (2001), Marina *et al.,* (2006), Avci *et al.,* (2007), Cakir *et al.,* (2008), Ocak *et al.,* (2009) and Punchbuddhe *et al.,* (2010).

Feed Consumption

The data on average weekly feed intake of broiler chicken as influenced by dietary inclusion of vitamin, mineral and probiotic is given in Table-2. The mean weekly feed intake revealed that the dietary inclusion of vitamins, minerals and probiotic either alone or in combinations at different levels had no significant (P<0.05) effect during first and second week of age.

However, there was numerical difference among different treatment groups. During third week, the average weekly feed intake revealed significant difference (P<0.05) among the treatment groups. The highest feed consumption (772.07±10.01 g) was recorded in the chicks fed diet supplemented with probiotic (T_4) which was significantly higher (P<0.05) than T_2 and T_7 which consumed 670.34±10.10 g and 710.53±8.42 g; respectively. It is pertinent to note that the birds of vitamin supplemented diet group (T_2) evidenced a lowest feed consumption (670.34±10.10 g) closely followed by the chicks of control group (T_1) i.e. 682.97±7.33 g. Vitamin supplemented diet (T_2) registered significantly (P<0.05) lower values than control groups (T_1) which were comparable.

Table.1 Average body weight gain (g) of broiler chicks at various ages supplemented with different feed additives

Age (week)	Treatments								
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	Overall
1st	77.36 ±1.72	76.95 ±1.99	76.73 ±2.05	75.79 ±1.86	75.43 ±1.90	76.80 ±2.05	77.47 ±2.40	77.85 ±2.21	76.79 ±0.62
2nd	125.90^{a} ±1.57	122.99^{a} ±1.26	137.73^{b} ±1.74	120.60^{a} ±1.94	135.44^{b} ±1.87	137.34^{b} ±1.69	139.20^{b} ±1.76	139.15^{b} ±1.75	132.29 ±2.57
3rd	299.06^{ab} ±2.60	288.49^{a} ±1.76	327.17^{d} ±1.75	351.95^{e} ±1.27	305.728^{b} ±1.74	322.40^{b} ±1.73	344.96^{e} ±1.88	360.61^{e} ±1.99	326.71 ±10.05
4th	299.47^{a} ±1.72	310.10^{b} ±1.66	328.61^{c} ±1.76	358.00^{e} ±1.56	382.76^{g} ±1.80	346.53^{d} ±1.77	374.24^{fg} ±1.73	371.72^{f} ±1.31	346.01 ±10.75
5th	302.25^{a} ±1.72	317.38^{b} ±1.74	336.03^{c} ±1.73	361.91^{d} ±1.34	383.49^{f} ±1.18	373.15^{e} ±1.11	377.16^{e} ±1.75	372.67^{e} ±2.18	357.00 ±10.79
6th	332.83^{a} ±1.61	327.92^{a} ±1.88	344.64^{b} ±1.75	369.46^{c} ±2.33	387.54^{e} ±1.85	390.74^{e} ±1.96	380.58^{d} ±1.97	391.72^{e} ±1.54	365.68 ±9.42

Values with same superscripts in a row did not differ significantly (P<0.05).

Table.2 Average weekly feed consumption by broiler chicks at various ages supplemented with different feed additives

Age (week)	Treatments							
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8
1st	118.39 ±8.97	123.47 ±6.95	119.09 ±8.27	112.13 ±7.16	118.23 ±7.69	116.03 ±9.47	123.18 ±8.47	113.65 ±7.44
2nd	230.73 ±8.94	233.41 ±8.92	244.56 ±8.43	220.32 ±9.06	227.75 ±8.67	235.27 ±10.78	247.07 ±8.83	246.36 ±7.08
3rd	682.97^{ab} ±7.33	670.34^{a} ±10.10	740.72^{c} ±8.34	772.07^{d} ±10.01	681.99^{ab} ±9.98	686.52^{ab} ±9.48	710.53^{b} ±8.42	709.74^{b} ±8.82
4th	575.43^{a} ±8.55	605.50^{ab} ±9.08	614.57^{b} ±11.01	815.52^{d} ±11.59	721.47^{c} ±11.70	716.46^{c} ±9.99	746.35^{c} ±9.41	732.77^{c} ±13.25
5th	846.20^{cd} ±13.82	802.13^{b} ±13.51	814.58^{bc} ±13.77	857.42^{d} ±11.84	870.73^{d} ±13.74	792.88^{b} ±12.17	798.82^{b} ±11.95	714.49^{a} ±13.92
6th	1165.43^{b} ^{c} ±11.25	1125.24 ^{a} ±13.99	1243.50 ^{e} ±12.87	1158.27^{ab} ±11.56	1121.10^{a} ±11.75	1129.87^{ab} ±10.6	1219.29^{de} ±11.2	1200.90^{cd} ±13.72

Value with same superscripts in a row did not differ significantly (P<0.05).

Table.3 Average feed conversion ratio of boiler chicks at various ages supplemented with different feed additives

Age (week)	Treatments							
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8
1st	1.52^{ab} ±0.08	1.60^{b} ±0.02	1.54^{ab} ±0.03	1.47^{ab} ±0.03	1.56^{ab} ±0.41	1.50^{ab} ±0.04	1.58^{ab} ±0.02	1.45^{a} ±0.15
2nd	1.84 ±0.03	1.91 ±0.03	1.77 ±0.01	1.82 ±0.02	1.67 ±0.02	1.71 ±0.03	1.77 ±0.01	1.70 ±0.75
3rd	2.28 ±0.02	2.32 ±0.00	2.28 ±0.01	2.10 ±0.03	2.23 ±0.01	2.12 ±0.00	2.15 ±0.07	1.96 ±0.00
4th	1.92 ±0.01	1.95 ±0.00	1.86 ±0.00	2.27 ±0.00	1.90 ±0.00	2.06 ±0.00	1.99 ±0.00	1.97 ±0.00
5th	2.79 ±0.03	2.52 ±0.00	2.42 ±0.01	2.36 ±0.00	2.27 ±0.01	2.12 ±0.00	2.11 ±0.00	1.91 ±0.01
6th	3.50 ±0.15	3.43 ±0.00	3.60 ±0.00	3.13 ±0.01	2.89 ±0.00	2.89 ±0.01	3.20 ±0.02	3.06 ± 0.02
Overall	2.31 ±0.22	2.29 ±0.21	2.25 ±0.22	2.19 ±0.18	2.08 ±0.21	2.07 ±0.18	2.13 ±0.17	2.01 ±0.15

Value with same superscripts in a row did not differ significantly (P<0.05).

Chicks fed diet containing vitamin and probiotic (T_4) though showed a marginally higher values (772.07±10.01 g) than vitamin, mineral and probiotic supplemented diet group T_8 i.e. 709.74±8.82 g but where statistically similar.

The average weekly feed intake during the fourth week of age showed that there was no significant (P<0.05) difference among treatment groups during the fourth week of age. During fifth week of age, the chicks given T_8 treatment group had significantly (P<0.05) lower feed intake than other treatment groups. The birds fed diet with be combination of vitamin, mineral and probiotic (T_8) recorded lowest feed intake (714.49±13.92 g). Chicks fed diet supplemented with combination of vitamin, mineral and probiotic (T_8) showed significantly (P<0.05) lower feed consumption than the other supplemented combination treatment groups and control group. Result indicated that the chicks fed diets supplemented with combination of vitamin, mineral and probiotic (T_8) lesser feed in comparison to control group (T_1) and other combination treatment groups. The higher feed consumption was recorded in combination of vitamin and mineral supplemented group T_5 (870.73±13.74 g) than control group T_1 (846.20±13.82 g). During sixth week of age, there was no Statistical no significant difference (P<0.05) in feed consumption among different treatment groups.

The results of present study are in accordance with the findings of Szezerbiska *et al.*, (2000), Asmita *et al.*, (2001), Sar, *et al.*, (2003), Arslan and Saatchi (2004), Elangovan *et al.*, (2004) and Sakhawat *et al.*, (2005) who reported that supplementation of feed additives did not show significant effect on feed consumption. However, the present findings did not agree with the findings of Marina *et al.*, (2006), Punchbuddhe *et al.*, (2010), Saied *et al.*, (2011) and Abdelrahman (2013) who reported that supplementation of feed additives showed significant effect. The differences in results might be due to differences in the feed ingredients added in the feed additives used in the experiment, type of chicks and the environmental factors.

Feed Conversion Ratio

The true yardstick of the measurement of nutritive value of feeding stuff is described in the performance of chicks in term of their productivity. The results of performance trait i.e. the value of Feed Conversion Ratio (FCR) during different phases of growth are presented in Table-3. The results of weekly feed conversion ratio values showed that the dietary inclusion of vitamin, mineral and probiotic had significant ($P<0.05$) effect only during the first week of age and in the remaining weeks the values were statistically comparable among treatments. From the results of first week of growth, it appears that the ratio of feed conversion was minimum (1.45±0.15) in group T_8, indicating the efficiency of utilization of feed in rations supplemented with combination of vitamin, mineral and probiotic (T_8) was superior to that of probiotic supplementation group (T_4), mineral and probiotic supplementation group (T_6), vitamin supplementation group (T_2), mineral supplementation group (T_3), vitamin and mineral supplementation group (T_5), vitamin and probiotic supplementation group (T_7), and control group (T_1). Out of these eight groups, vitamin supplemented group (T_2) proved to be least efficient with a value of 1.60±0.08 followed by T_4 (1.47±0.03), T_6 (1.50±0.04), T_3 (1.54±0.03), T_5 (1.56±0.41), T_7 (1.58±0.02) and T_2 (1.60±0.02); respectively.

During fifth week of age, the feed conversion ratio was best for T_8 group diet supplemented with vitamin, mineral and probiotic. Diet supplemented with vitamin (T_2 group) had lower feed intake than control group T_1. According to the data, it may be seen that a significantly ($P<0.05$) lower feed conversion ratio (1.91±0.01) was exhibited in the birds of T_8 group, containing combination of the vitamin, mineral and probiotic followed by the chicks of group T_2 (2.52±0.00) i.e. vitamin supplemented diets, exhibited significant variation within the groups. Diets with combination of vitamin, mineral and probiotic group (T_8) and vitamin and probiotic supplemented group (T_7) and mineral, probiotic supplemented group (T_6), registered significantly ($P<0.05$) lower value of feed conversion ratio as compared to control group (T_1). Vitamin, mineral and probiotic supplemented group (T_8) showed significantly ($P<0.05$) lower feed conversion ratio value than control group (T_1), thereby reflecting better feed of utilization.

Results of feed conversion ratio (FCR) indicated that there was improvement in the efficiency of feed utilization when the diets were supplemented with vitamin, mineral and probiotic. The present findings revealed that probiotic, mineral and vitamin in combination or alone as feed additive had better impact on nutrient utilization and its conversion into soft and hard body tissues as compared to control. Similar findings in respect of use of feed additives and probiotics on feed conversion ratio in poultry also have been reported by various workers like Maiorka *et al.*, (2002), Shinde *et al.*, (2005), Iyayi and Davies (2005), Pakhira and Samanta (2006), Paryad and Mahmoudi (2008), Bozkurt (2008), Cakir *et al.*, (2008), Shareef and Dabbagh (2009), Pervez and Sajid (2011), Mehmet and Ayhan (2012), Amer and Khan (2012) and Ogunwole *et al.*, (2012). In general, the feed consumption and feed conversion ratio under supplemented with different feed additives was observed to be better than control group.

Based on the result obtained in the present study, it can be concluded that the response of feed additive alone and combination of feed additives reflected by change in body

weight gain during growth period was significantly better than that of control in deep litter system of management in poultry. The diet of birds supplemented with feed additives and their combination of feed additive resulted in better growth efficiency in broiler chicks. So, use of non-antibiotic feed additive particularly mixing of all vitamin, mineral and probiotic at recommended dose have the potential to be applied as effective substitute for getting good economical return in the broiler farming.

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