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Influence of Dietary Multiple Phase Feeding on Growth Performance of Commercial Broiler Chicken

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ABSTRACT

The experimental trial was carried out to study the effect of multiple phase feeding on the growth performances and the economics of broiler production for a period of six weeks. Day-old chicks (n=160) were divided into two treatment groups, each containing 80 chicks with four replicates in each treatment. The birds of the control group (A) were fed prestarter, starter and finisher diets as per nutrient requirement of commercial broiler strain used in the experiment and the multiple phase feeding was followed in group-B by changing the nutrient densities (Energy, Crude protein, lysine and methionine) of diet per week. The different performance parameters were studied such as live body weight, gain in live body weight, feed conversion ratio and feed consumption at weekly interval. Mortality was recorded daily and the economics was calculated at the end of experiment. The results of experiment showed that the body weight and weight gain of broilers of group-B was significantly higher ($p<0.05$) than that of broilers of group-A during first, second, fifth and sixth week of age and also during overall duration of the experiment. Further, the feed intake of broilers of group-B was significantly higher ($p<0.05$) than that of group-A during second, fifth and sixth weeks of age and also during the overall feed intake of broilers. The Feed Conversion Ratio of broilers of group-B was significantly better ($p<0.05$) than that of group-A during fifth week and also during the overall performance. The multiple phase feeding has not put any adverse effect on percentage mortality of broilers. However, broilers fed with the multiple phase feeding showed higher net profit per bird and also per kg of body weight as compared to the broilers of control group (A).

Key words: Broiler chicken, Growth performance, Multiple phase feeding.

INTRODUCTION

The purpose of phase feeding is to provide adequate nutrients at specific points in the physiological age of the bird to meet managerial goals. Phase feeding is commonly used to implement different feed programs. Phase feeding (PF) is a nutrition program that was described by Emmert and Baker (1997) as a flexible alternative to the NRC recommendations. Because amino acid requirements of broilers decrease steadily as the birds grow older, there is a need for diets with various levels of amino acids. Instead of the three-step NRC program, PF involves a more frequent reduction in dietary amino acid content and allows for the prediction of broiler amino acid requirements for any age during the grow-out period.Phase-feeding has the potential to be a more efficient feeding system because it should result in lower dietary amino acid levels while still maintaining adequate growth performance and carcass yield. Moreover, amino acid level in the diet of broilers affects nitrogen excretion, so when dietary amino acid levels are decreased, the amount of nitrogen that is excreted should be reduced, which would have a positive environmental impact. There is also a great potential for decreasing the cost of production because of increased efficiency and decreased amino acid supplementation of poultry diets. Skinner *et al.,* (1993) noted that, the different diets, which were prepared to meet the nutrient requirement of the meat type chickens for particular feeding programs paid less attention towards economics. The BIS (2007) gave the nutrient recommendation for the preparation of broiler feed, which were divided into three fixed periods such as 1) Pre-Starter period which were fed up to the 1st week, 2) Starter period which were fed from 2nd to 3rd week and 3) Finisher period which were fed from 4th week to 6th week of age.

According to Eits (2004), proteins are important nutrients of broiler diets, because they affect production performances, feed cost and nitrogen excretion. Proteins are most important for broiler growth, feed conversion efficiency and the quality of carcass (Saharei, 2013). In this respect, different diets of variable nutrient composition has been suggested for phase feeding of broilers**,** based on reducing its crude protein content with the advancement of age. Some research has indicated that broiler requirements for proteins and amino acids changed over the time, so constant use of one diet for a long time would result in a surplus or deficiency of nutrients in the most of the growth

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period. In respect of this, Belyavin (1999) suggests that broilers during the period of growth should be given more different diets, basing their diet on multi-phase feeding programs. Some research has indicated that mashes with reduced protein content do not affect body weight, but do affect fattening efficiency (Warren and Emmert, 2000; Saleh *et al.,* 1996). Research also implies that nitrogen excretion is directly related to protein content in mashes and according to Ferguson *et al.* (1998), manipulations in broiler diets can reduce nitrogen content in manure, with the retaining of acceptable production performances. Saleh *et al.* (1996) noted that, reduction in the protein content of feed led to reduction in feed cost, so that, it is economically beneficial to change the diet within short interval. According to Waller (2007) when we are facing with the crisis of increased cost of feed and its ingredients then the first option was to see the economic impact of reduction in nutrient specification of feed to minimize the cost of the feed on the business. Previous research has concluded that amino acid levels may be decreased weekly or even every other day with a phase feeding program without negatively affecting growth performance or carcass yield (Warren and Emmert, 2000; Pope and Emmert, 2002). Keeping the above facts in view, the present study has been studied with the effect of multiple phase feeding on the performance of broiler chicken.

MATERIALS AND METHODS

One hundred sixty Mareks Disease vaccinated day old broiler straight run chicks of "Cobb 430Y" strain were procured from private hatchery. The experiment was carried out at the Department of Poultry Science, Krantisinh Nana Patil College of Veterinary Science, Shirwal dist. Satara from 08th May to 18th June 2019 for period of six weeks. The chicks were equally and randomly distributed in to two treatment groups (Table 1). Each treatment groups were further divided in to four replicates with twenty chicks in each replicate. The corn-soy based Broiler Pre-starter (BPS), Broiler Starter (BS) and Broiler Finisher (BF) diets were prepared as per nutrient requirement of commercial broiler strain used in the experiment and fed ad libitum to the birds of control group (A) from 0-14, 15-28 and 29-42 days of age respectively and the birds of treatment group (B)were fed by changing the diet in every week of the total six week trial (Table 2). The chicks were vaccinated against Ranikhet and Gumboro disease vaccines at 7th and 14th days of age respectively. Uniform standard managemental practices were provided throughout the experimental period *i.e*. up to six weeks of age for all the treatments groups. The broiler birds in all the treatment groups were subjected on full feeding programme. Birds from each group were weighed individually on day 0 and at weekly intervals. Mean live body weight gain (g/ b) was computed at different growth phases of study. Measured quantity of feed was offered every day and the left over feed was recorded after 24 hrs. The difference between the feed offered and balanced feed was worked out to know the actual feed consumed by each group on a particular day. The feed consumption was calculated and expressed as g/b. On the basis of weekly live weights and weekly feed consumption, the values of FCR of each group were calculated. Mortality was recorded for each treatment groups and was expressed as livability at the end of experimental period. The feed cost per kg body weight gain in broilers reared under different treatment regimen of the present study was calculated based on feed consumption during the 3-42 day's period. The data obtained on various parameters studied during this experimental trial were subjected to statistical analysis as described by Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

Weekly live body weight and weight gain

The live body weight of broilers from group B was observed significantly higher ($p<0.05$) than that of group A during first, second, fifth and sixth week of age (Table 3). At the end of

Table 1: Experimental design.

Treatment group	Treatment group details	No. of birds/pen/ replication	No. of replication	Total number of birds
A	Control – Basal Diet as per industry standards	20	4	80
B	Diet variation in every week	20	4	80
	Total birds			160

Table 2: Nutrient densities of control (A) and treatment (B) groups diets.

Treatment groups		Pre-starter		Starter		Finisher	
Control (A)		ME- 2900Kcal/kgCp- 23% Lysine- 1.3% Methionine- 0.55%		ME- 3000 Kcal/kgCp- 22% Lysine- 1.2% Methionine-0.50%		ME- 3100 Kcal/kgCp-20% Lysine- 1.00% Methionine- 0.45%	
		1st week	2nd week	3rd week	4th week	5th week	6th week
Treatment (B)	ME Kcal/kg	2850	2900	2950	3000	3050	3100
	CP %	23	22.5	22	21.5	21	20.5
	L-Lysine %	1.35	1.3	1.25	1.20	1.15	1.0
	DL-Methionine %	0.55	0.525	0.50	0.475	0.45	0.425

Table 3: Effect of multiple phase feeding on weekly live body weight of broilers.

Age	Live body weight			Body weight gain		
	A (±SEM)	B (±SEM)	CV	A (±SEM)	B (±SEM)	CV
Day old	46.17±0.09	46.15± 0.03	0.26			
1 Week	180.93^{b}±1.28	190.20^{a}±0.97	2.90	134.8^{b}±1.24	144.1^{a}±0.95	3.86
2 Week	418.68^{b}±2.56	438.65^{a}±1.25	2.64	237.8^{b}±1.36	248.5^{a}±1.82	2.65
3 Week	767.75±4.25	778.15±4.84	1.31	349.1±3.81	339.5±5.77	3.02
4 Week	1144.25±13.39	1123.38±12.90	2.36	376.5±10.54	345.2±16.65	8.52
5 Week	1544.18^{b}±20.87	1637.45^{a}±20.38	3.95	399.9^{b}±9.35	514.1^{a}±18.37	14.60
6 Week	1947.83^{b}±25.46	2205.00^{a}±23.91	7.13	403.7^{b}±15.31	567.6^{a}±19.33	20.35
Overall (0-6 Week)				1901.7^{b}±25.46	2158.9^{a}±23.9	7.29

Means bearing different superscripts within the row differed significantly ($p<0.05$).

first week, live BW of broilers from group B was significantly higher ($p<0.05$) than that of group A, even though the group B is provided with less energy content than that of the group A, this may be due to the higher lysine content of the diet during the first week as compared to the control group. Similar result was observed by the Kidd *et al.* (2004); they reported that the average BW of bird's specifically male bird showed higher body weight when fed with high nutrient density diet (lysine) as compared to the other dietary treatments. The mixing of extra methionine and lysine improved the growth rate because both amino acids were instantly absorbed into the body, requiring no prior digestion unlike when whole proteins are consumed. During the second week of experiment the live BW of broiler from group B was higher than the group A even though the diet is having reduced crude protein and methionine level than the control group A. This shows that the birds during second week of age can perform well even if the crude protein and methionine content is reduced by maintaining the energy and lysine level constant as control group. The live BW of boilers from group A and B at the end of third and fourth week were not significantly different. During fifth week the group B birds have significantly higher ($p<0.05$) BW than the group A this may be due to the higher crude protein and lysine content of the diet of the group B birds than the control group A. At the end of experimental trial treatment group (B) birds were heavier than the control group (A) birds. Similar results were also found by Mudhunguyo and Masama (2015); Mehmood *et al.,* (2014) and Hauschild *et al.* (2014).

Weekly feed consumption (FI)

The average FI of broilers from group B was significantly ($p<0.05$) higher than that of group A were observed during second, fifth and sixth week of age and also during the cumulative FI from 0-6 weeks of age (Table 4). After completion of first week feed consumption of group B broiler is numerically higher than that of group A broiler. These results were accordance with Swennen *et al.* (2011) who stated that when amino acids in the feed are at optimum levels, chickens will increase FI in an effort to meet their requirements, in another study Lisnahan *et al.* (2017) reported that the supplementation of extra methionine and lysine into diets at the starter phase improves the feed intake. At the end of second week FI of broilers of group B was significantly ($p<0.05$) higher than that of group A broiler, the broilers of group B consumed more feed may be because of diet is having less protein content than that of group A broiler, to fulfill their protein need broilers of group B consumed more feed compared to the group A broiler. The weekly average FI after completion of third and fourth week did not show significant difference between the control group (A) and treatment group (B). The weekly FI of group B broiler at the end of fifth week was significantly ($p<0.05$) higher than that of group A, here broilers of group B consumed more feed may be due diet is having less energy content compared to group A. To fulfill the energy need of body, broilers of group B may be consumed more feed than control group (A) broilers. The weekly average FI of treatment group (B) at the end of sixth week was significantly ($p<0.05$) higher than that of control group (A).

Table 4: Effect of multiple phase feeding on weekly feed intake of broilers.

Age	A (±SEM)	B (±SEM)	CV
1 Week	146.2±2.9	153.2±2.4	4.11
2 Week	312.3^{b}±4.6	330.5^{a}±3.6	3.86
3 Week	523.1±9.1	534.1±8.3	3.25
4 Week	712.6±11.2	680.8±12.5	3.99
5 Week	858.1^{b}±16.9	926.5^{a}±15.8	5.32
6 Week	931.2^{b}±16.5	1246.0^{a}±10.7	15.64
Overall	3483.5^{b}±26.3	3871.0^{a}±24.1	5.77

Means bearing different superscripts within the row differed significantly ($p<0.05$).

The overall feed intake of treatment group (B) broilers was significantly ($p<0.05$) higher than that of control group (A) broilers. The overall increment of cumulative feed consumption was @11.14% in multiple phase feeding group. Similar results were also found by Mehmood *et al.,* 2014 that the 4-phase feeding program exhibited significantly ($p<0.05$) highest feed intake as compared to single, two and three phase feeding pattern. Loupe and Emmert, 2000 also reported that over the complete experiment (0 to 6 weeks) birds fed a phase feeding regimen had an increased ($p<0.05$)

feed intake relative to birds fed NRC requirements throughout.

Weekly feed conversion ratio (FCR)

It was observed that the FCR during initial four week of experiment between group A and group B were not significant (Table 5). The FCR of treatment group (B) was significantly better at the end of fifth week and numerically improved at the end of sixth week as compared to the control group A. The overall FCR in the multiple phase feeding group B was found improved @2.79% than the control group A. These results are matches with Mostert (2016) who reported that cumulative feed conversion ratio was improved in birds fed with high protein diet compared to the birds fed low protein diet. Mudhunguyo and Masama (2015) reported that the better feed conversion ratio was observed under four phase feeding program as compared to two or three phase feeding program. Mehmood *et al.* (2014) recorded improved FCR in 4-phase feeding program as compared to single, two and three phase feeding pattern. Similar results were obtained by Pope *et al.* (2004). These results might be due to exact nutrient requirement was made available during particular period/age of bird and nutrient was utilized efficiently by the birds.

Weekly mortality

The overall mortality in broilers during the experimental period was 1.87% (Table 6), which occurred in both treatment groups. The percentage mortality of control group (A) broilers was 1.25% and percentage mortality of treatment group (B) broilers was 2.5%. There is no such critical difference between the percentage mortality of control group (A) and treatment group B broilers. The overall mortality *i.e*. 1.87% which was within the acceptable limit. The multiple phase feeding has not put any negative effect on percentage mortality in broilers.

Table 5: Effect of multiple phase feeding on weekly feed conversion ratio of broilers.

Age	A (±SEM)	B (±SEM)	CV
1 Week	1.19±0.03	1.06±0.01	4.31
2 Week	1.32±0.02	1.33±0.01	2.16
3 Week	1.50±0.03	1.57±0.02	4.22
4 Week	1.90±0.03	1.98±0.06	5.25
5 Week	2.15^{b}±0.02	1.81^{a}±0.05	9.94
6 Week	2.37±0.06	2.20±0.07	6.38
Overall	1.84^{b}±0.01	1.79^{a}±0.01	1.71

Means bearing different superscripts within the row differed significantly ($p<0.05$).

Table 6: Effect of multiple phase feeding on percentage mortality of broilers.

Treatment group	No. of birds	No. of dead birds	Mortality (%)
A	80	1	1.25
B	80	2	2.5
Overall	160	3	1.87

Economics

The net profit per bird for the control group (A) and treatment group (B) were Rs. 26.51 and 40.34, respectively. And the net profit per kg of body weight was Rs.13.59 and 18.25, respectively. It was seen that the broilers fed with the multiple phase feeding shown the higher net profit per bird and also per kg of body weight as compared to the broilers fed on control diet. This is because of the broilers fed with the multiple phase feeding attained higher overall body weight as compared to the broilers fed on control diet. It was concluded that multiple phase feeding was useful in earning maximum profit per bird because of higher live weight.

CONCLUSION

The broilers fed with the multiple phase feeding showed the significantly higher live body weight, weight gain, improved feed conversion ratio and higher net profit per bird and also per kg of body weight as compared to the broilers fed on the control diet.

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