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Diets with High Amino Acid Density Can Improve Broiler Performance and Increase in Profit

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Abstract

This study was conducted at the Institute of Agriculture and Animal Science (IAAS), Rampur, Chitwan for evaluating performance and carcass characteristics of broilers fed with two grades of diets varying in nutrient densities; high amino acid density (HG) diet and medium amino acid density (MG) diet. Two hundred and eighty straight run unsexed Cobb 500 broiler chicks were randomly assigned to two treatment groups with seven pens per treatment such that each pen consisted of 20 chicks. Control birds received MG diet in three phase feeding system viz. pre-starter: 1-15 days, starter: 16-25 days, and grower: 26-38 days. Treatment birds received HG diet in two phase feeding system viz. starter: 1-15 days, and grower: 16-38 days. The birds were provided with diets in crumbled form. At 38 days, with HG diet, feed conversion ratio (FCR) decreased ($p<0.05$) by 13.72%; body weight, carcass yield, and breast meat increased ($p<0.05$) by 15.45%, 2.92% and 10.46% respectively. Total feed intake and incidence of mortality among two treatments remained unaffected. At day 38, HG diet produced net profit of NRs. 20.97 per bird. It is suggested that HG diets give better performance with respect to weight gain, FCR, carcass yield and net profit compared to MG diets.

Key words: broiler, carcass, FCR, feed intake, nutrient density

Introduction

Poultry sector is undergoing rapid commercialization in Nepal since a decade. This sector shares around 3-4% of the total GDP (MoAC 2011). The population of commercial broilers and layers has reached 32 and 7.48 million respectively in 2010/11 and the total poultry population is estimated to be around 39.5 million (MoAC 2011). The poultry sector has been growing at a rate of 10 % per annum over the last decade (Ryan & Pant 2011). The net meat production during the year 2010/11 was 2,77,625 mt, out of which the contribution from chicken was 36,085 mt (MoAC 2011). There are around 50 feedmills, including 11 pellet mills, producing 4,50,000 mt of feed per annum ((Ryan & Pant 2011) .

Broiler chickens share around 81% of the total poultry population in Nepal (MoAC 2011). These are also the major meat type birds in Nepal. More than 70% of the commercial broilers raised in Nepal are heavy breeds. Majority of these breeds are Cobb 500/400, Hubbard, Marshall, LIR, Ross 308, etc. They are generally marketed at 1.5- 2.5 kg body weight in around 38-50 days of age. However, during the time of less chicken demand or low ready bird prices, they are kept up to 3-3.5 kg body weight and gradually marketed as the price progresses. Farmers are paid more for the birds which are greater than 2 kg live weight. So, they are more willing to sell the birds at least an average weight of 2 kg. This will generate more profit for them. On an average, Nepalese poultry raisers generally produce 4-5 batches of broiler chickens per annum. Dietary modifications could decrease the slaughter age of the birds and produce more than six batches of broilers

per annum. Use of high amino acid density (HG) diets could be one of such dietary modifications.

Feed is the major tool to extract total genetic capabilities from the birds besides good housing and management. Several previous researches have demonstrated improved performance of birds by the use of high nutrient density diets. Dietary nutrient density is one of several nutritional factors that has a significant impact on the growth and health of broiler chickens, which in turn affect the economics of broiler production (Mabray & Waldroup 1981, Reece & Mc Naughton 1982, Campbell *et al,* 1988). Manipulation of nutrient density has been shown to affect growth performance and carcass quality (Jones & Wiseman 1985). Lott *et al*. (1992) reported higher body weight and improved feed efficiency with high-energy rations. High nutrient density diets improve growth performance and meat yield (Holsheimer & Reusink 1993, Dozier & Moran Jr 2001). Fortifying diets with a higher proportion of amino acids from 1 to 35 d of age is advantageous with respect to meat yield when broilers are marketed at heavy body weight (Kidd *et al*, 2004). As the nutrient level in feed increases, the cost of feed will increase but the revenue generated will also increase due to bird's high level of performance. This trial aimed to see the performance and carcass characteristics of broilers on HG diets and economics associated with it.

More than 90% of broiler farmers in Nepal use commercially available feed and about 65% of them are pellet feed users. There are around 11 pellet feed industries in Nepal each with a capacity of more than 200mt per day. More than 90% of the Nepalese feed industries are currently practicing a 3-4 phase feeding system for broilers viz. B0 (Broiler pre-starter), B1 (Broiler starter), B2 (Broiler grower) and B3 (Broiler finisher). A downtime associated with production of four varieties of products in a feed mill is high because of adding the additional diets. This study would also test two phase feeding system for broilers (with HG starter and grower diets). If the net profit associated with this feeding program comes higher at farmer's level, only two types of broiler feed products could be manufactured by Nepalese feed industries, as this will reduce the downtime involved in changing the products and increase feed mill efficiency.

Methodology

This study was conducted in 2012 A.D at the Institute of Agriculture and Animal Science (IAAS) livestock farm, Chitwan, Rampur. Two hundred and eighty straight run day old unsexed Cobb 500 broiler chicks were randomly sampled from the hatchery for the study. The birds were divided into two treatment groups with one group based on MG diet and the other based on HG diet. Each treatment was replicated seven times with each replicate/pen consisting of twenty chicks. This way each of the treatment groups consisted of 140 chicks. The birds were reared in deep litter system made up of rice husk. Each pen was provided with equal sized feeder and drinker. Feed and water were provided ad libitum. The feed was manufactured in crumbled form by Probiotech Industries Pvt Limited (Nimbus), Nepal.

The composition of diets and their proximate values are presented in Table 1 and 2.

Table 1. Composition of diets

Ingredients	B1HG	B2HG	B0MG	B1MG	B2MG
Maize	188	231	210	186	191
Soybean meal	314	242	261	225	183
MBM	35	40	35	25	25
DORB	-	-	-	52	81
Rice Polish	88	88.39	102.14	109.85	118.88
Wheat	300	325	300	300	300
Broken Rice	50	50	50	50	50
Limestone	6.75	4.61	9.11	10.65	9.62
Soya Oil	3.5	5.5	-	-	-
Mustard DOC	-	-	20	30	30
Salt	2.75	1.5	2.75	1.5	1.5
Sodium bicarbonate	1.0	1.5	1.5	2.0	1.50
L lysine HCL	1.80	1.90	1.83	1.75	1.70
D L Methionine	1.65	1.50	1.40	1.070	0.97
L Threonine	0.45	0.60	0.43	0.55	0.86
Betaine	2	1.5	2	1.5	1.5
Mycosorb	0.50	0.50	0.50	0.50	0.50
Vitamins/Minerals	1.50	1.50	1.50	1.50	1.50
Lincomed	0.08	0.10	0.08	0.08	0.08
Coccidiostat	0.21	0.55	0.21	0.55	0.55
Econase XT	0.10	0.10	0.10	0.10	0.10
Quantum 5000	0.20	0.20	0.15	0.15	0.15
Eurotiox	0.04	0.04	0.03	0.03	0.03
Others	2.47	2.01	0.27	0.22	0.56
Total, Kg	1000	1000	1000	1000	1000

*B1*HG- High amino acid density starter, B2HG- high amino acid density grower, B0MG- medium amino acid density pre-starter, B1MG- medium amino acid density starter, B2MG- medium amino acid density grower.

Table 2. Proximate value of the diets

Nutrient composition	B1HG	B2HG	B0MG	B1MG	B2MG
ME (Kcal/kg)	2980	2980	2932	2932	3000
CP %	22.49	20.54	22.07	21.67	19.74
EE %	4.43	4.33	4.70	4.70	5.56
CF %	4.51	4.60	3.80	3.78	3.06
Calcium %	1.01	0.92	1.35	1.32	1.12
Total Phosphorous %	0.73	0.66	0.55	0.55	0.6
Dig. Lysine %	1.20	1.10	1.10	1.020	0.88
Dig. Methionine (M)%	0.44	0.42	0.40	0.39	0.35
Dig. M+Cysteine%	0.86	0.82	0.79	0.76	0.69
Dig. Tryptophan%	0.19	0.19	0.18	0.17	0.16
Dig. Threonine%	0.78	0.75	0.71	0.69	0.62
Dig. Arginine%	1.26	1.19	1.15	1.10	0.97
Dig. Isoleucine%	0.80	0.76	0.74	0.70	0.62
Dig. Valine%	0.92	0.88	0.85	0.82	0.71

Note: B1HG- High amino acid density starter, B2HG- high amino acid density grower, B0MG- medium amino acid density pre-starter, B1MG- medium amino acid density starter, B2MG- medium amino acid density grower.

Table 3. Feeding program

Treatments	HG starter (B1HG)	HG grower (B2HG)	MG pre-starter (B0MG)	MG starter (B1MG)	MG grower (B2MG)
T1	-	-	1-15 days	16-25 days	26-38 days
T2	1-15 days	16-38 days	-	-	-

HG- High amino acid density, MG- Medium amino acid density

Weight gain, feed intake and FCR were measured on 15th and 38th day. All the twenty birds from each replicate/pen were weighed with the help of electronic balance and the average age was recorded. For carcass measurements, 2 birds from each pen, i.e, 14 birds from each treatment were used. Birds were fasted for 12 hours (ad libitum water was provided) before slaughter for studying carcass characteristics. Carcass yield was recorded by international method (head, neck, feet and viscera were removed). Economic assessments were based on diet costs and live weight gains. Diet cost was based on retail price of feed as provided by manufacturer (Probiotech Industries, Pvt. Ltd) at the time of the trial.

The experiment was conducted in a completely randomized design (CRD). For significance test, one way analysis of variance (ANOVA) was performed. Treatment means were compared by least significant difference ($p<0.05$) using M- Stat C Version 1.3.

Results and Discussion

Performance of broilers under different dietary treatments

There was no significant difference ($P>0.05$) in feed intake between the treatment groups till day 15 or day 38 (Table 4). However, HG diets improved body weight ($P<0.05$) measured at 38 days of age. The body weight was increased by 266 g which is 15.45% more than the group fed with MG diet. Similarly, there was significant improvement in FCR ($P<0.05$) through HG diet

(Table 4). Feeding high amino acid density diets decreased FCR by 28 points or 13.72%. Kidd *et al.* (2004) reported an 11% increase in 49 day body weight with Ross × Ross 508 broilers which were provided diets formulated to a high amino acid density vs. moderate amino acid density.

Table 4. Effects of medium and high amino acid density diets on the performance of broilers

Dietary	Feed intake (g)				Body weight (g) 38 days	Corrected Feed Conversion ratio (FCR)	Mortality (%)
	1-15 days	16-25 days	26-38 days	1-38 days			
MG diet	567[a]	1068	1884	3519[a]	1721[b]	2.04[a]	4.28
HG diet	565[a]	2941		3506[ab]	1987[a]	1.76[b]	3.57

[a-b] Means within a column not sharing a common superscript differ significantly ($P < 0.05$)
FCR was corrected for mortality by adding the weight of the dead birds.

The mortality rate among two dietary treatments remained unaffected with less than 1 percent difference in mortality (Table 4).

Carcass characteristics of broilers under different dietary treatments

Carcass yield and breast meat yield were significantly higher ($P<0.05$) in HG diet group (Table 5). Carcass yield and breast meat yield were increased by 2.92% and 10.46% respectively.

Table 5. Effects of medium and high amino acid density diets on carcass characteristics

Dietary Treatments	Percentage of live body weight at day 38	
	Carcass	Breast muscle
MG diet	68.45 [b]	20.45 [b]
HG diet	70.45 [a]	22.59 [a]

[a-b] Means within a column not sharing a common superscript differ significantly ($P < 0.05$)

Sibbald and Wolynetz (1986) found similar increment in breast meat yield with high lysine containing feed.

Economic analysis

The use of HG diets in T2 till day 38 could produce a net gain of NRs. (112.81-91.84)/bird, i.e, net gain of NRs. 20.97 per bird compared to T1 based on MG diets (Table 6).

In Nepal, barter system is predominant in poultry business. In this system, dealers provide chicks to the farmers and purchase ready birds from their farms. Farmers are paid as per total kilograms of live bird weighed. So, profitability to farmers is measured as per unit of live weight gain rather than the carcass weight. In some cases, producers have their own slaughter house/fresh house. Carcass weight is of utmost importance in such cases.

Table 6. Economics of broiler production in terms of feed cost and return

Feed Type	Average feed consumed/ bird (in kg) and cost involve	
	T1	T2
MG pre-starter	0.567	0
Cost @ NRs. 39.80 /kg	22.57	0
MG starter	1.068	0
Cost @ NRs. 38.15/kg	40.74	0
MG grower	1.884	0
Cost @ NRs. 36.40/kg	68.58	0
HG starter	0	0.565
Cost @NRs. 42.55/kg	0	24.04
HG grower	0	2.941
Cost @ NRs. 41.30/kg	0	121.46
Total feed consumed per bird (kg)	3.519	3.506
Feed cost/bird in NRs. (x)	131.89	145.50
Avg live wt/bird (Kg)	1.721	1.987
Avg income per bird @ Rs. 130/kg live wt (y)	223.73	258.31
Feed cost/kg live wt. of bird (NRs.)	76.63	73.22
Return to farmer/ live bird in NRs. (y-x): cost of chicks(NRs. 40/chick) and other non-feed cost not included	91.84	112.81

HG- High amino acid density, MG- Medium amino acid density, T1- Medium amino acid density (MG) diet group, T2- High amino acid density (HG) diet group.

Thus, with high amino density (HG) diets birds attain marketable weight earlier and it is possible to increase number of batches of chickens produced per year.

Birds in medium amino acid density (MG) diets will take some more days and some more feed to attain the same weight. So, even if we calculate the profitability after the birds attain the same weight as of HG diet, we save that extra amount of feed intake and extra days that are needed to produce the same weight. For producers who have their own slaughter house/fresh house, profitability by using HG diet is even higher due to increment of 2.92% in carcass yield.

Nepali poultry market has turned volatile since few years where price of chicks and ready birds are unpredictable. Last few years' trend show that the demand for chickens and ready bird prices are higher for almost half a year. For rest of the time, it is difficult for the farmers to sell the chickens on time due to surplus in the market. So, it would be wise to think on the use of HG diets around the time when the demand together with the price is expected to increase. When the demand is high, it is profitable to produce chickens of marketable weight as early as possible.

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