Effects of Three Dietary Metabolizable Energy Levels on Growth Performance and Carcass Fat Contents of 28-35 Days Old Broiler Chicken

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ABSTRACT

Since the energy requirement and energy intake are complex issues involving many genetic, management and environmental conditions, determination of the optimum dietary energy level for modern fast growing broilers are difficult. Objective of this study was to determine the effects of three dietary energy levels on growth performance and carcass fat contents of 28-35 days old broiler chicken. Two diets were prepared by increasing the dietary metabolizable energy (ME) level of a commercial broiler finisher diet (control) from 3100 to 3200 and 3300 Kcal/kg by mixing coconut oil at 0.0221 and 0.0453g/kg, respectively with the control diet. Giving a completely randomize design with 6 replicate pens per each treatment, 54 broiler chicks received one of the above three diets ad libitum from day 28 to 35. Day time feeding rate of the birds fed 3300 Kcal was significantly higher than those fed diets containing either 3200 or 3100 Kcal/kg. Feeding rates after 11.30 am was significantly lower than that of early hours. Water intake rate was not affected by the dietary energy level but by the time of the day. Total feed and water intake was not significantly affected by the dietary energy level. Though the total energy intake of the birds fed 3300 Kcal diet was significantly higher than the birds fed other two energy levels, there was no significant difference in energy efficiency ratio. (EER) None of the growth performance parameters and visceral organ weights was significantly affected by the dietary energy level. 3300 Kcal diet significantly increased the cloacal and total fat (cloacal + gizzard) fat content. Digesta transit time was not significantly influenced by the dietary energy level. It was concluded that 28-35 day old broilers do not adjust their feed intake when dietary ME level increased from 3100-3300 Kcal/kg. Furthermore, increase of dietary ME level from 3100 to 3300kcal/ kg during day 28 to 35 had no beneficial effects on growth performance but increased the carcass fat content.

Keywords - Broiler, Carcass fat, Metabolizable Energy.

1. INTRODUCTION

Energy alone contributes to about 70% of the total cost of poultry diets. Therefore determining the level of energy of a diet is probably the most important decision to be made in formulating diets for poultry [1]. Proper energy levels will optimize growth, carcass quality and feed efficiency. It has generally been assumed that chickens tend to eat to meet their energy needs and thus adjust their feed intake according to the dietary energy level. However, recent studies have shown that higher dietary energy levels have positive effects on growth rate and feed efficiency [2]. This improvement in growth rate is due to the fact that the modern broiler has been primarily selected to consume feed at almost full capacity regardless of the dietary energy level. Rapid gains on the other hand allow more meat to be produced in a given time so that capital costs of housing, equipment and labor may be reduced [3].

Controversy exists regarding the influence of dietary energy levels on carcass composition and quality. In general, carcass fatness will not change as long as the C:P (Calorie to protein) ratio remains constant; otherwise, carcass fatness increases as dietary energy level increases [4].

High environmental temperature levels reduce the feed intake and thereby broiler performance. The first objective of this study was to determine whether broilers of 28-35 days adjust their feed intake when their dietary energy level is increased. NRC recommended 3200 Kcal ME/kg for broilers from 21-42 days [5]. The second objective was to determine the effects of three dietary energy levels on growth performance and carcass fat content of broiler chicken.

2. METHODOLOGY

The experiment followed a completely randomize design. Twenty eight days old broiler chicks (Cobb 500) were assigned into 18 floor pens and pens were randomly assigned into replicates of three experimental diets. The pens were equipped with one feeder and a drinker. Fresh paddy husks were used as litter material. Giving three experimental diets, the ME level of a commercial broiler finisher diet (control) having 3100 Kcal/kg was raised to 3200 and 3300 Kcal/kg by mixing coconut oil at 0.0221 and 0.0453g /kg, respectively with of the control diet. The nutrient composition (as given by the manufacturer) of the control diet was 20% protein, 7% fat, 7.5% ash, 5% fibre, 1% calcium and 0.65% phosphorus. The experimental diets were fed for one week. Water and feed consumption of each pen were measured daily. Day time (8.30 am-6.00 pm) intake rates (g/hr) of feed and water were determined for every 1.5 hours for four consecutive days. Digesta retention time was determined on day 34. Birds were offered the feed at 8.00 am after six hours of feed deprivation. The time of first faecal pellet expulsion was recorded for one randomly selected of each pen. The time difference between the feed offered and the time of first faecal pellet expulsion was considered as the rate of gastric transit time. One randomly selected bird was killed on day 35 for the determination of carcass parameters such as weights of heart, liver, gizzard, crop, proventiculus, pancreas, fat (gizzard and cloaca) and weight and length of digestive tract [6]. Data were analyzed using SPSS as a completely randomized design. Significant means were compared using DMRT procedure.

3. RESULTS AND DISCUSSION

Day time temperature increased from morning and reached to the maximum during 1.30 to 3.00 pm (Table 1). The feeding rate during early hours (8.30 to 11.30 am) was significantly higher than that of during 11.30 am to 6.00 pm. The high environmental temperature prevailed during 11.30 am 4.30 pm may be the reason for lower feeding rate of that period. It is interesting to note that during high temperature time windows of the day (10.00 am-4.30 pm), birds reduced the water intake rates as well. Reduction in drinking rate may partly be due to the close relationship between feeding and drinking behaviors of broilers. Furthermore, reduction of drinking rate may reflect the general reduction of activities under high environmental conditions. However, increased water intake rate:feed intake rate suggests that drinking behavior is lesser affected by high temperature than feeding behavior.

Table 1. Effect of different day time segments on feeding and drinking rates of 28-35 days old broiler chicken

Time	Mean Temperature (C)	Feeding rate (g/h)	Drinking rate (ml/h)	Drinking rate: feeding rate
8.30-10.00am	32.1	44.2[a]	136.6[a]	3.1[b]
10.00-11.30 am	34.7	33.4[a]	120.6[b]	3.7[ab]
11.30am-1.30 pm	35.7	25.0[b]	110.0[b]	4.6[a]
1.30-3.00pm	36.0	24.8[b]	110[b]	4.5[a]
3.00-4.30pm	34.0	25.8[b]	108.1[b]	4.4[a]
4.30-6.00pm	32.00	28.5[b]	91.3c	3.3[b]
SEM		1.3	5.2	0.4
ANOVA P value		0.001	0.001	0.01

Despite the high environmental temperature, day time feeding rate of the birds fed 3300 Kcal was significantly higher than those fed diets containing either 3200 or 3100 Kcal/kg (Table 2). Total feed intake was not affected by the dietary energy level. The total energy intake was also high when 3300 Kcal diet was fed. These observations support the argument that modern day fast growing broilers eat to their full capacity despite the dietary energy level [7].

Total water intake and water:feed ratio were also not significantly affected by the dietary energy level. Results of this experiment suggest that under high environmental conditions both feed and water intakes are more dependent on temperature than on dietary energy level.

Though the total energy intake of the birds fed 3300 Kcal diet was significantly higher than the birds fed other two energy levels, there was no significant difference in energy efficiency ratio. None of the growth performance parameters and visceral organ weights was significantly affected by the dietary energy level. Though the percentage gizzard fat was unaffected, 3300 Kcal diet significantly increased the cloacal and total (cloacal + gizzard) fat content. It must be noted that a slight dilution in other nutrients such as protein and amino acids resulted in due to the addition of coconut oil. Digesta transit time was not significantly influenced by the dietary energy level [8].

Table 2. Effect of dietary ME levels on growth performance of 28-35 days old broiler chicken

Parameter	Dietary ME level (Kcal/kg)			SEM	ANOVA P value
	3100	3200	3300		
Live weight (g)28 d	1026	1029	1026	10.0	0.97
Live weight (g) 35 d	1549	1581	1602	25	0.34
Weight gain (g)	522.3	551.8	575.8	20.5	0.21
Total feed intake (g)	1138	1137	1180	21	0.3
FCR	2.17	2.00	2.00	0.96	0.39
Water intake (ml)	3221	3311	3221	196	0.93
Water:feed	3.0	2.67	2.67	0.172	0.315
Energy intake (K cal)	3528[b]	3638[b]	3894[a]	67.865	0.005
EER (gain/1000 Kcal of ME)	148.5	151.7	147.8	5.9	0.88
Cloacal fat (%)	2.10[b]	2.20[b]	3.62[a]	.20	0.000
Gizzard fat (%)	0.76	0.73	0.73	0.12	0.97
Total fat (%)	2.86[b]	2.86[b]	4.36[a]	0.25	0.01
Gastric transit time (Min)	121.5	134.8	123.1	7.0	0.375
Feeding rate	28.5[b]	29.9[b]	32.6[a]	0.93	0.01

4. CONCLUSION

It was concluded that 28-35 days old broilers do not adjust their feed intake when dietary ME level increased from 3100-3300 Kcal/kg. Furthermore, increase of dietary ME level from 3100 to 3300 during day 28 to 35 had no beneficial effects on growth performance but increased the carcass fat content.

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