Nig. J. Anim. Prod. 2003, 30(2):157-162

Response of broilers to 3 weeks feed restriction initiated at different time periods

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Abstract

One hunded and forty four Anak broilers were subjected to either ad libitum feeding or 50% ad libitum feeding for a period of 3 weeks starting from 2nd, 3rd, 4th, 5th or 6th week of age and then returned to ad libitum feeding to market age. Feed intake was significantly reduced (P<0.05). Initiation of broilers to 50% of ad libitum feeding at the 2nd week of age produced a significantly higher weight gain and better feed to gain ratio compared with the control (P<0.05). Initiation of broilers to 50% ad libitum feeding beyond the 3rd week resulted in poorer performance of broilers compared with the control (P<0.05). Feed restriction as applied in this study did not have any significant effects on broilers initiated at the 2nd or 3rd week and the control. However, retention of these nutrients were significantly reduced (P<0.05) in birds initiated into feed restriction beyond the 3rd week. The economic data showed that 50% of ad libitum feeding initiated at the 2nd week of age resulted in significant reduction in the cost of production and cost to benefit ratio (P<0.05). The benefit in terms of Naira and kobo was also significantly increased (P<0.05). It was then concluded that, initiating broilers to 50% of ad libitum feeding for 3 weeks starting at the 2nd week of age offered a better economic gain than the usual ad libitum feeding..

Keywords: Feed restriction, 50% of *ad libitum* feeding, cost to benefit ratio, feed intake, nutrient retention, weight gain

Introduction

The scarcity and ever rising cost of feeds and feedstuffs have been the most important factors militating against increased commercial poultry production in the developing countries. Feed accounts for between 65 – 80% of the total cost of raising commercial poultry in Nigeria (Babatunde and Fetuga, 1980). In an effort to address this and associated problems of *ad libitum* feeding, feed restriction programmes are being advocated.

Early feed restriction have been reported, but each report varies in degrees and qualification of feed restriction and the extend of the subsequent compensatory growth after feed restriction. Robinson *et al.*,(1992) reported that feed

restriction of 50 – 60% of *ad libitum* feeding during the 2nd week of life was found to have no adverse effect on body weight and feed to gain ratio at market age. This study was designed to investigate the response of broilers to 50% of *ad libitum* feeding for 3 weeks, initiated at different time periods.

Material and Methods

One hundred and forty-four Anak broilers were housed in an electrically heated brooder cage. Chicks were randomly assigned into one of six treatment groups and fed the diet in Table 1.

Table 1 *Percentage Composition of experimental diet*

Ingredient	%
Yellow maize	54.00
Groundnut cake	29.03
Maize offal	7.54
Blood meal	3.00
Palm oil	3.00
Bone meal	2.55
Oyster shell	0.28
Salt(common)	0.25
*Vit. Min premix	0.25
DL-methinione	0.10
Analysed nutrient content	
Dry matter %	97.30
Protein %	20.28
Fat %	5.02
Fibre %	6.17
ME (Calculated Kcal/Kg)	3047

*provide per kg of diet, Vitamin A (8000IU); Vitamin D3(1,200IU); Vitamin E (3IU); Vitamin K3 – Kastab (2mg), Vitamin B2 – Riboflavin (8mg), Vitamin B3 – Nicotinic acid (10mg), Vitamin B5 – Pantothenoic acid (150mg), Manganese (Mn), (80mg) Zinc (Zn) (50mg);Copper (Cu)(2mg); Iodine (I) (1.2mg); Cobalt (Co)(0.2mg), Selenium (Se) (0.1mg).

During the one week of stabilization, the diet was supplied *ad libitum* at the end of which birds in treatment groups 2,3,4,5 and 6 were subjected to 50% of *ad libitum* feeding for 3 weeks starting from 2nd, 3rd 4th, 5th or 6th week of age respectively. Broilers in treatment group 1 served as the control on *ad libitum* feeding throughout. Each treatment group was replicated thrice. Broilers were returned to *ad libitum* feeding after their respective 3 weeks of feed restriction. Water was supplied to satisfaction during and after restriction period.

Half way into the restriction period, a nutrient retention trail was conducted for the different groups and the control. Weighted quantity of feed was supplied and excreta sample collected over 72 hours using total collection method. The samples were dried in the oven at the temperature of 60°C for 48 hours. The samples were then weighed and ground prior to chemical analysis. Proximate composition of feed and faecal samples were determined using the method of A.O.A.C. (1980).

At the end of the feeding trial, 3 chicks were randomly selected from each replicate pen, weighed and killed by exanguination. The birds were carefully defeathered and dissected. The adipose tissue surrounding the gizzard and intestine, extending within the ischium and surrounding the cloaca, bursal of fabricius and adjacent abdominal muscle was collected and weighed as the abdominal fat. Carcass weight was also taken. Data collected were subjected to analysis of variance using the model for completely randomized design (Steel and Torrie, 1980). T-test or Duncan Multiple Range Test (Duncan, 1955) was used where applicable to separate significant means.

Results

Table 2 shows the effect of 50% feed restriction on the performance of broilers during the period of feed restriction. For broilers initiated at 2nd, 3rd, 4th, 5th, and 6th week, average feed intakes were 461, 623, 793, 911 and 1185g respectively; while weight gains were 282, 295, 314, 277 and 390g respectively. Feed intake and weight gain were significantly reduced ($P<0.05$) for all dietary treatment at their different times of feed restriction compared with the control using T-test. The effect of 50% feed restriction on the performance of broilers at market age is shown in Table 3. For broilers initiated at the 2nd, 3rd, 4th, 5th and 6th week, average feed intake range from 3671, 3433, 3059, 2941 to 2763 respectively; average weight gains, 1528, 1494, 1281 and 1140g respectively with the corresponding feed/gain ratio of 2.31,2.30,3.39,2.44 and 2.43 respectively. Generally these value were significant when compared 4059g, 1509g, and 2.69 values for feed intake, weight gain and feed/gain ratio in broilers on *ad libitum* feeding. Initiation of feed restriction at the 2nd week significantly increased body gain ($P<0.05$). However, initiating feed restriction at the periods beyond the 3rd week significantly reduced body weight gain compared with the control ($P<0.05$). Mortality was not significantly affected by feed restriction ($P>0.05$).

Table 2 *Effect of 50% feed restriction[1] on broilers performance*

Treatments	Restricted Period			Post Restricted		
	Feed Intake(g)	Weight Gain(g)	Feed Gain ratio	Feed Intake(g)	Weight Gain(g)	Feed Gain ratio
Ad libitum feeding	963[b]	456[b]	2.12[b]	3001	976[a]	3.08[b]
2nd – 4th week restriction	461[a]	282[a]	1.64[a]	3115	1239[b]	2.51[a]
SEM	113	41	0.12	74	65	0.11
Significance	*	*	*	NS	*	*
Ad libitum feeding	1310[b]	573[b]	2.29	2461	749[a]	3.33[b]
3rd – 5th week restriction	623[a]	295[a]	2.11	2520	1008[b]	2.50[a]
SEM	154	66	0.09	40	67	0.21
Significance	*	*	NS	*	*	*
Ad libitum feeding	1688[b]	610[b]	2.77	1732[b]	509[a]	3.40[b]
4th – 6th week restriction	793[a]	314[a]	2.53	1635[a]	585[a]	2.80[a]
SEM	201	67	0.12	28	22	0.51
Significance	*	*	NS	*	*	*
Ad libitum feeding	1993[b]	681[b]	2.93[a]	1008	295[b]	3.42[b]
5th – 7th week restriction	911a	277[a]	3.28[b]	988	395[b]	2.50[a]
SEM	242	90	0.11	23	31	0.34
Significance	*	*	*	NS	*	*
Ad libitum feeding	2461[b]	739[b]	3.33	1598	806	1.98
6th – 8th week restriction	1186[a]	390[a]	3.04	1578	786	2.01
SEM	288	85	0.18	17	20	0.02
Significance	*	*	NS	NS	NS	NS

* Mean within column followed by different superscripts differ significantly.
[1] – Restriction was at 50% of *ad libitum* feeding for 3 weeks.

Table 3 *Effect of 50% feed restriction[1] on broilers performances (0 –8 weeks)*

Treatment	Feed Intake(g)	Weight Gain(g)	Feed Gain ratio	% Mortality
Control(*ad libitum* feeding)	4059^{c}	1509^{c}	2.69^{c}	9.53
2nd – 4th week restriction	3671^{d}	1582^{d}	2.31^{a}	0.00
3rd – 5th week restriction	3433^{c}	1496^{c}	2.30^{a}	4.76
4th – 6th week restriction	3059^{b}	1281^{b}	2.39^{a}	0.00
5th – 7th week restriction	2941^{ab}	1209^{ab}	2.44^{a}	0.00
6th – 8th week restriction	2763^{a}	1140^{a}	2.43^{a}	0.00
SEM	111	42	0.04	1.29
Significance	*	*	*	NS

* Mean followed by different superscripts within column differ significantly. (P<0.0%)
[1] – Restriction was at 50% of *ad libitum* feeding for 3 weeks.

Table 4 presents the effects of 50% feed restriction on nutrient utilization by broilers. For broilers initiated at the 2nd, 3rd, 4th, 5th and 6th week, protein retention values were 68.51, 68.63, 69.51, 67.51 and 69.51% respectively; fat retention value of 81.49, 72.12, 69.77 and 72.53% respectively with the corresponding fibre utilization value of 39.27, 39.36, 41.88, 43.42 and 42.70% respectively. Protein retention was comparable (P>0.05) for broilers initiated feed restriction after the 2nd and 3rd weeks both compared with the control. However, initiating feed restriction after the 3rd week resulted in a significant reduction of protein retained (P<0.05). both fat retention and fibre utilization were not significantly affected by feed restriction (P>0.05). The effect of 50% feed restriction on carcass percentage and abdominal fat of broilers are shown in Table 5.

Table 4 *Effect of 50% feed restriction[1] on nutrient utilization by broilers*

Treatment	Protein(%)	Fat(%)	Fibre(%)
Ad libitum feeding	67.39	79.11	39.33
2nd – 4th week restriction	68.51	81.49	39.27
SEM	1.75	2.14	0.33
Significance	*	NS	NS
Ad libitum feeding	71.09	74.81	40.58
3rd – 5th week restriction	68.63	72.07	39.36
SEM	1.01	0.78	0.38
Significance	NS	NS	NS
Ad libitum feeding	73.01^{b}	76.11	43.03
4th – 6th week restriction	69.51^{s}	70.12	41.88
SEM	1.14	2.19	0.54
Significance	*	NS	NS
Ad libitum feeding	73.98^{b}	74.28	43.80
5th – 7th week restriction	67.51^{a}	69.77	43.42
SEM	1.14	2.15	1.07
Significance	*	NS	NS
Ad libitum feeding	73.98^{b}	75.28	44.89
6th – 8th week restriction	69.51^{a}	72.53	42.70
SEM	1.13	1.16	0.90
Significance	*	NS	NS

* Mean within column followed by different superscripts differ significantly.
[1] Restriction was at 50% of *ad libitum* feeding for 3 weeks.

Table 5 *Effect of 5% feed restriction[1] on carcass percentage and abdominal fat of broilers*

Treatment	Carcass(%live Wt)	Abdominal Fat	
		Absolute weight(g)	%Carcass
Control (*ad libitum* feeding)	82.82[b]	30.7[ab]	2.40[ab]
2nd – 4th week restriction	86.68[b]	25.1[a]	1.96[a]
3rd – 5th week restriction	87.44[b]	28.6[a]	2.28[a]
4th – 6th week restriction	78.46[a]	29.7[a]	3.14[b]
5th – 7th week restriction	77.96[a]	32.0[b]	2.46[ab]
6th – 8th week restriction	84.65[b]	25.7[a]	2.56[ab]
SEM	1.12	2.09	0.21
Significance	*	*	*

* Mean followed by different superscripts within column differ significantly. (P<0.0%)
[1] – Restriction was at 50% of *ad libitum* feeding for 3 weeks.

Initiating feed restriction at 2nd, 3rd, 4th, 5th and 6th week resulted in carcass percentage of 86.68, 87.44, 78.46,77.96 and 84.65% respectively and abdominal fat value of 25.1, 28.6, 29.7, 32.0 and 25.7g respectively. Carcass percentage was generally comparable (P>0.05) especially affected in those birds initiated into restriction at the 2nd or 3rd week. Abdominal fat was not significantly (P>0.05). Table 6 shows the effect of 50% feed restriction on the economics of broiler production. Initiating feed restriction at the 2nd, 3rd, 4th, 5th or 6th week resulted in the cost of production values of 120.48,115.91, 108.74, 106.46 and 103.04 Naria respectively; benefit of 156.23, 144.23, 115.08, 104. 94 and 96.92 Naira per bird respectively with the corresponding cost to benefit ratios of 0.77, 0.81, 0.95,1.01, and 1.07 respectively. Generally, cost of production was significantly reduced (P<0.05) by feed restriction. Benefit that accrued from the sales of the birds was significantly increase for broilers initiated into feed restriction at the 2nd week (P<0.05), while it was significantly reduced (P<0.05) for those initiated at the periods beyond the 3rd week. Cost to benefit ratio was significantly reduced (P<0.05) for broiler initiated at the 2nd or 3rd week compared with the control. However, this was significantly increased (P<0.05). For birds initiated into feed restriction at the 6th week.

Table 6 *Effect of feed restriction[1] on the economics of production of broilers*

Treatment	Cost of production(₦)	Benefit/bird(₦)	Cost/Benefit Ratio
Control (*ad libitum* feeding)	127.48[e]	134.75[e]	0.95[b]
2nd – 4th week restriction	120.98[d]	156.23[d]	0.77[a]
3rd – 5th week restriction	115.91[c]	144.23[b]	0.96[b]
4th – 6th week restriction	108.74[b]	115.08[ab]	1.01[bc]
5th – 7th week restriction	106.46[ab]	104.94[ab]	1.07[c]
6th – 8th week restriction	103.04[a]	96.92[a]	1.07[c]
SEM	2.14	5.34	0.03
Significance	*	*	*

* Mean followed by different superscripts within column differ significantly. (P<0.0%)
[1] Restriction was at 50% of *ad libitum* feeding for 3 weeks.
Cost of production: cost of feeding plus cost of day old chicks. Cost of medication, labour and others not included
Benefit: Revenue minus cost of production

Discussion

The significant reduction in weight gain during the period of feed restriction regardless of the age of bird is a direct response to feed intake. The post-restriction period showed that broilers initially restricted gained more weights than those on *ad libitum* feeding. This could be due to the fact that at post-restriction, broilers had more access to feed. However more importantly, these birds exhibited compensatory growth, which has been defined as the rate of growth exceeding that normally observed in the same breed of chicken at the same age (Yu *et al.*, 1990).

Auckland *et al.*,(1969) reported that the major factor responsible for compensatory growth after feed restriction in medium strain turkey was the increase feed consumption relative to body size. Appetite has a strong influence on the growth rates of poultry (Marks, 1979). At the market age, only bird initiated early enough that is at 2nd or 3rd week of age had either better or comparable weight gain respectively when compared with control. Since accompanying this was a significant reduction in feed intake, this resulted in improved feed efficiency. This observation could also be attributed to the fact that broilers in these two groups had longer relimentation after the period of feed restriction. A cursory look at the progression of the data on performance reveals that the older the age of the birds before coming into feed restriction, the lighter the weight at market age. Presumably, the realimentation time was not enough for birds to compensate for earlier reduction in feed intake and at older ages, the growth rate must have been reduced since they might have been approaching the point of inflexion in the sigmoid growth curve. Mc Cartney and Brown (1977) showed that a period of compensatory growth occurred in male and female broilers of approximately 2 weeks after returning to *ad libitum* feeding. Robinson *et al* .,(1992), concluded that feed restriction of 50 – 60% of *ad libitum* feeding during the 2nd week of life was found to have no adverse effect on body weight and feed to gain at market age. The comparable protein and fat retention and especially that of protein offer credence to the performance of broilers initiated to feed restriction at either the 2nd or 3rd week.

Feed restrictions as applied in this study, did not affect broilers survival. Abdominal fat, a factor that downgrades carcass quality was not influenced by the restriction method. Economically, feed restriction at the 2nd or 3rd week showed a better performance in terms of reducing cost of production and cost to benefit ratio. However from the forgoing, initiating broilers to 50% of *ad libitum* feeding for 3 weeks starting at the 2nd week of age resulted in better performance than the usual *ad libitum* feeding with the resultant, increase benefit and reduced cost to benefit ratio.

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(Received 12 December 2000; Accepted 17 April 2002)