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Research Article

EFFECT OF FEED RESTRICTION DURING GROWING PERIOD ON GROWTH AND EGG PRODUCTION PERFORMANCE OF WHITE LEGHORN LAYERS

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ABSTRACT

Effect of quantitative feed restriction during growing period on mature body weight, subsequent egg production and egg quality was investigated in this experiment. A total 144 pullets of White Leghorn were randomly assigned to three treatments as; T_1: (control) was fed *ad libitum* diet; T_2: was fed diet with 20% restriction and T_3: was fed diet with 30% restriction during growing phase (9-20 weeks). Result of this study showed that body weights (g/bird) at the end of 20th week were significantly lower in T_3 (1395.87) group followed by T_2 (1431.54) group as compared to the T_1 (1486.00) group. Moreover, feed restriction delayed age at sexual maturity. Hen-day egg production and feed conversion ratio were not significantly affected by the treatments. The egg quality traits were not affected in layers due to feed restriction during growing phase. Feed restriction at 20% had higher return (8.8%) over feed cost than the control. It is concluded that feed restriction during rearing phase in White Leghorn resulted in lower body weights and delayed age at sexual maturity. However, it did not have any effect on egg production and quality.

Keywords: Body weight, Cost, Egg production, Feed restriction, Pullets

Egg plays a very vital role in meeting the nutritional requirements of the growing world population. The high biological value of egg forms an indispensable component in the fulfillment and satisfaction of the high-quality nutritional requirement of an ever-expanding human population. Optimum feeding management practices followed during the rearing period in pullets have important effects on body weight, uniformity, egg production, egg weight, egg quality and hatching properties (Sarica *et al.*, 2009). Feed restriction is a procedure that can be applied during growing period to manipulate the feeding strategies of poultry in order to decrease growth and metabolic rate to some extent and to get desirable body weight during laying which in return helps to delay sexual maturity and increases production performance of the birds without affecting their welfare or health (Tesfaye *et al.*, 2009). Earlier studies have revealed that feed restriction in the rearing period has important effects on the laying traits. Thus, the present study was planned to evaluate the effects of feed restriction during growing period on growth, egg production and egg quality traits of White Leghorn layers.

MATERIALS AND METHODS

The present study was conducted at Sub-department of Avian Production and Management of Department of Livestock Production and Management, College of Veterinary Science and Animal Husbandry, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar which is located in semi-aridregion of north Gujarat. A total 144 pullets (9 weeks of age) of White Leghorn were randomly assigned to three treatments viz. T_1 (control), fed *ad libitum* diet; T_2, fed diet with 20% restriction and T_3, fed diet with 30% restriction during growing phase (9-20 weeks). During chick (0-8 weeks) and layer (21-40 weeks) phase, birds were fed standard diet as per BIS (1992) specification to meet their nutrient requirements. The ingredients and chemical composition of diet fed to birds during different phases are presented in Table 1. The

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Table 1

Ingredients and chemical composition of experimental diets

Ingredients (%)	Chick (0-8 weeks)	Grower (9-20 weeks)	Layer (21-40 weeks)
Maize grain	40.00	40.00	50.00
Soya bean meal	33.00	18.00	26.00
De-oiled Rice Barn	20.00	20.00	12.00
Rice Polish	6.60	21.00	6.00
Limestone	—	0.65	—
Salt	0.30	0.30	0.30
Lysine	0.03	—	0.02
Methionine	—	—	0.02
Toxivin	0.05	0.05	0.05
Choline	0.02	—	—
Ventrimix❖	—	—	0.01
Shell girt	—	—	5.60
Chemical Composition (%)			
Protein	21.31	16.62	18.09
Fat	6.31	3.57	4.68
Fibre	4.58	5.27	6.28
Lysine*	1.04	0.72	0.84
Methionine*	0.30	0.32	0.33
Metabolizable energy* (Kcal/kg)	2857.08	2875.50	2806.60

❖contains Vitamin A - 82,500 IU, Vitamin B_2 - 50 mg, Vitamin D_3 - 12,000 IU, Vitamin K - 10 mg per gram; *calculated values as fed basis

chemical composition of diets was determined as per the procedures of AOAC (1995). The housing, feeding and watering were provided as per standard rearing protocol. The birds were weighed individually at the beginning of the experiment (8 weeks of age) and thereafter at the interval of two weeks during growing phase. Age at sexual maturity in days and body weight at sexual maturity in grams were also recorded. To determine layer performance parameters like age at first egg, average weekly feed intake, feed conversion ratio (feed intake/dozen eggs and feed intake/kg egg mass), hen daily production and egg weight were recorded. The egg quality was monitored as egg shape index, shell thickness, yolk index, albumen index and Haught unit. Feed were weighed at the beginning of the week and left-over feed at the end of each week were recorded for the calculation of average feed intake. The impact of feed restriction on economics was determined in terms of return over feed cost and profit over feed cost. Data obtained from experiment were statistically analyzed using one-way analysis of variance (ANOVA). Significant differences among the treatments were determined with Duncan's multiple range tests. Statistical significance was set at $p<0.05$.

RESULTS AND DISCUSSION

Growth performance: The effect of feed restriction during growing period on growth performance of pullets is given in Table 2. The average body weight was 607.25 ± 7.97, 609.95 ± 8.17 and 615.20 ± 8.56 g/bird in T_1, T_2 and T_3 group, respectively, at 8 weeks of age. The body weights (g/bird) at the end of 20th week were significantly lower in T_3 (1395.87 ± 10.45) group followed by T_2 (1431.54 ± 11.40) group as compared to the T_1 (1486.00 ± 8.74) group. The lower body weights were expected in birds fed diets at 20 and 30% restriction groups than the *ad libitum* fed group. The findings of this study are in agreement with those of Fassbinder-Orth and Karasov (2006) who observed lower body weights and feed intake in birds fed restricted diet. Age at sexual maturity (days) was 129 ± 6.35, 134.5 ± 3.87 and 141.5 ± 4.81in T_1, T_2 and T_3 groups, respectively, indicating delayed age of sexual maturity after feed restriction of 20 and 30% in T_2 and T_3 groups, respectively. The reason might be due to the distribution of available energy to different organs during the feed restriction to make priority for tissue growth (Tesfaye *et al.*, 2009). Similarly, Sarica *et al.* (2009) reported delayed sexual maturity in birds fed 10 or 20% restriction diet.

Egg production: The average hen day egg production (%) were not affected in T_2 (80.08 ± 1.74) and T_3 (75.66 ± 1.66) groups as compared to T_1 (77.74 ± 1.93) group, due to feed restriction during growing period (Table 3). The finding is in line with earlier reports of Sekoni *et al.* (2002), Leeson *et al.* (2005), Singh *et al.* (2008) and Sarica *et al.* (2009)

Table 2

Effect of feed restriction during growing period on growth performance of pullets (n=144)

Age in weeks	Treatments		
	T_1	T_2	T_3
Body weight changes (g/bird)			
W8	607.25±7.97	609.95±8.17	615.20±8.56
W10	715.45±8.61	713.16±8.35	716.25±8.39
W12	840.58±8.47	834.29±9.01	830.37±10.30
W14	975.12±9.34	968.04±10.25	962.08±9.92
W16	1167.16±9.75	1150.50±11.34	1140.45±10.69
W18	1308.50±10.59^{a}	1286.45±13.45^{ab}	1271.16±12.11^{b}
W20	1486.00±8.74^{a}	1431.54±11.40^{b}	1395.87±10.45^{c}
Gain in body weight (g)			
W8-10	108.20±3.65	103.21±4.82	101.05±3.89
W10-12	125.12±6.57	121.12±2.69	114.12±4.49
W12-14	134.54±3.97	133.75±3.69	131.70±3.99
W14-16	192.04±6.28	182.45±4.73	178.37±6.05
W16-18	141.33±4.52	135.95±5.78	130.70±3.79
W18-20	177.50±7.58^{a}	145.08±4.02^{b}	124.70±3.03^{c}
Other parameters			
Age at first egg (days)	114.50±8.65	117.00±6.47	120.50±4.87
Age at sexual maturity (days)	129.00±6.35^{a}	134.50±3.87^{b}	141.50±4.81^{c}
BW at sexual maturity (g)	1352.50±8.04^{a}	1364.83±11.56^{a}	1406.04±9.59^{b}

^{a,b} - Means with different superscripts within the row differ significantly at $P<0.05$

Table 3
Effect of feed restriction during growing period on egg production performance of White Leghorn layers (n=144)

Age in weeks	Treatments		
	T_1	T_2	T_3
Hen day egg production (%)			
20-22	71.88	70.68	69.20
22-24	78.13	78.42	75.15
24-26	84.97	85.42	80.36
26-28	89.73	89.73	86.16
28-30	87.11	90.39	85.86
30-32	83.74	85.95	80.52
32-34	76.46	81.52	76.14
34-36	70.19	77.38	71.88
36-38	68.39	71.60	67.61
38-40	66.82	69.73	63.83
Overall	77.74±1.93	80.08±1.74	75.66±1.66
Feed intake (W_{21}–W_{40})	22.91±0.21[a]	23.05±0.23[ab]	23.55±0.17[b]
FCR (W_{21}–W_{40}) [Feed intake/dozen eggs]	2.25±0.42	2.19±0.34	2.27±0.41
FCR (W_{21}–W_{40}) [Feed intake/kg egg mass]	3.84±0.77	3.68±0.60	3.74±0.72

[a,b] - Means with different superscripts within the row differ significantly at P<0.05

who indicated that earlier feed restriction in pullets did not affect egg production during laying phase. In present study, it was observed that there was compensatory increase in feed consumption during laying phase in feed restricted groups which was significantly (P<0.05) higher in the birds subjected to 30% feed restriction than the birds from 20% feed restriction group followed by control group during growing period. Sarica *et al.* (2009) also found that feed intake can increase at the onset of the laying period according to the level of feed restriction. Feed conversion ratio in terms of feed intake/dozen eggs or feed intake/kg egg mass was similar among the different treatment groups (Table 3). In line with present findings, Fasuyi and Ojo (2012) did not find any improvement in feed conversion ratio in layers fed restricted diet during growth phase.

Egg quality: The feed restriction either at 20 or 30% did not have any significant impact on egg weight in this study (Table 4). Similar egg weight values for control and restricted groups were also reported in earlier studies (Sarica *et al.*, 2009; Fasuyi and Ojo, 2012). The egg quality parameters like shape index, shell thickness, albumen index, yolk index and Haugh unit score were not affected (p>0.05) in White Leghorn layers due to feed restriction during growing phase (Table 4). These findings are in agreement with Ukachukwu and Akpan (2007) and Fasuyi

Table 4
Effect of feed restriction during growing period on egg quality characteristics of White Leghorn layers (n = 144)

Parameters	Treatments		
	T_1	T_2	T_3
Egg weight (g)	48.90±1.22	49.77±1.10	50.75±0.94
Shape index (%)	75.36±0.29	74.87±0.27	74.77±0.27
Shell thickness (mm)	0.357±0.02	0.356±0.02	0.351±0.03
Albumen index (%)	7.61±0.11	7.55±0.10	7.58±0.10
Yolk index (%)	37.24±0.25	36.99±0.22	37.29±0.25
Haugh unit score (%)	74.29±0.57	73.76±0.47	74.06±0.51

Table 5
Effect of feed restriction during growing period on feed cost economics of White Leghorn layers (n=144)

Parameters	Treatments		
	T_1	T_2	T_3
Total feed intake (kg)	1099.7	1106.4	1130.4
Cost of feeding (Rs.15/kg of feed)	16495	16596	16956
Total numbers of eggs produced	5302	5431	5341
Income through sale of eggs (Rs.4/egg)	21208	21724	21364
Return over feed cost (Rs.)	4713	5128	4408
Profit over control diet (%)	-	+8.81	-6.47

and Ojo (2012) who reported that feed restriction in pullets had non-significant effect on egg quality. In contrast, other studies (Tolkamp *et al.*, 2005; Sarica *et al.*, 2009) reported that feed restriction in the rearing period had effect on egg weight at the onset of laying and some quality traits.

Feed cost economics: Total cost of feeding (Rs.) was almost similar among the different treatment groups (Table 5). The return over feed cost (Rs.) was 4712.8, 5128 and 4408 in T_1, T_2 and T_3 groups, respectively. Profit over control diet was higher (+ 8.81%) in group fed diet at 20% restriction and negative (- 6.47%) in group fed diet at 30% restriction during rearing phase. Olawumi (2014) observed an overall net benefit in birds with feed restriction when compared to control group reflecting a better economics of feed restriction programme.

It is concluded that feed restriction during growing phase (8-20 weeks) in White Leghorn resulted in lower body weights in pullets and delayed age at sexual maturity. However, feed restriction did not have any significant effect on egg production and egg quality. Feed restriction at 20% given better return over feed cost and profit in White Leghorn layers.

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