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Nutritional Manipulations During Induced Moult in White Leghorn Layers 2. Effects on Per cent Hen Day Egg Production, Body Weight and Reproductive System

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ABSTRACT

One hundred and sixty eight, 70 weeks old (average weight: 1.48 ± 0.02 kg), White Leghorn Single Comb commercial layers were used, to study the effects of different moult diets on post-moult (PM) egg number, body weight and changes in the reproductive system. They were randomly divided into 21 experimental units having eight hens each. During moult phase, after fasting, seven rations varying in crude protein (CP) i.e. 14, 16 and 18% and metabolizable energy (ME) i.e. 2700 and 2900 kcal/kg, along with a exclusively corn based diet fed to experimental groups. Maximum (62.67%) PM % hen-day egg production was among the birds fed moult diet having 16% CP, 2900kcal/kg ME, and minimum (45.83%) at 18% CP, 2900kcal/kg ME. The highest body weight (1.48kg) was noted at pre-moult stage compared to lowest (1.08kg) at PM stage. Higher % hen day egg production and less but lean live body weight was attained with 16% CP, 2900 kcal/kg ME diet.

Key Words: Moult; Protein; Energy; Egg production; Ovary weight; Oviduct weight

INTRODUCTION

Various procedures are employed as forced moulting techniques, to lengthen the total egg laying period of the hens in a permissible way. Hens fed a low protein cracked corn diet or the feeding of low nutrient, unbalanced or maintenance rations during post-fast-pre-lay period led to good PM performance (Brake *et al.*, 1979). In another study, it was supported that hens receiving 16% crude protein (CP) moult diet, regained body weight (BW) more quickly following the fast, came into production faster and attained peak sooner than those having 9% CP diet, with supplemented methionine (Koelkebeck, 1991).

Although different nutritional manipulations and feeding regimens have been adopted during induced moulting, however, no concrete information is available that how the level of protein and energy can be manipulated in moult induction as a post-fast feeding regimens to optimize the PM production. Therefore, present study was launched to optimize the protein and energy levels in moult diets and to explore its effects on % hen day egg production, BW and reproductive performance.

MATERIALS AND METHODS

One hundred and sixty eight, 70-weeks old White Leghorn Single Comb layers of commercial Euribred strain, maintained in the cages, were randomly divided into 21 experimental units of eight each. The moulting schedule is given below:

Days	Medication/ vaccination	Feed	Water (hrs)	Light (hrs)
	PRE-MOULT			
1	Farbenda @ 0.1 ml/kg Body Weight (Deworming)	ad-lib	24	24
2	ND (vaccine)	ad-lib	24	24
3-5	NFC-100 @ 1.5g/L(Antibiotic)	ad-lib	24	24
	MOULT			
	1-fasting			
1-10	Electrolyte	No	6	6
	2-Post-fast			
11-35		45 g/bird skip a day ER*	6	6
	POST-MOULT			
1-12 weeks		ad-lib (layer mash)	Step-up to 16 hr.	same as light

(Ahmed *et al*., 1995; Abdullah *et al*., 1996; Akram *et al*., 1998)
*= Experimental rations

Seven experimental rations varying in CP content i.e. 14, 16 and 18% and each combining with metabolizable energy (ME) 2700 and 2900 kcal/kg in addition to a control purely on corn were allotted at random to three replicates of eight hens each. These rations viz. A, B, C, D, E, F and G were formulated according to the requirement given by NRC (Anonymous, 1994) by using the locally available ingredients. The ingredients and chemical composition of these rations are mentioned in Table I.

Body weight of birds were noted on weekly basis. Ovary and oviduct weight and reproductive tract length were recorded at PM and at 50% production stage (50%P stage); while % hen day egg production was recorded weekly. The data thus, collected were subjected to statistical analysis for interpretation of results by using analysis of variance technique in completely randomized design (Steel & Torrie, 1980).

RESULTS AND DISCUSSION

Body Weight. Body weight was calculated at the end of each week, through out the experimental period. Maximum (P<0.0002) BW (1.32kg) was observed in hens fed ration having 14% CP, 2700kcal/kg ME, in contrast to non significant (P>0.05) trend with 10% CP, 3400kcal/kg ME; 14% CP, 2900kcal/kg ME and 16% CP, 2700kcal/kg ME. The minimum (P<0.0002) BW (1.25kg) was noticed with moult diet having 18% CP, 2700kcal/kg ME. Among weeks, the highest (P<0.05) BW (1.48kg) was found to be during 1st week, whereas lowest (P<0.05) BW (1.08kg) at 5th week. The results are presented graphically in Fig. 1.

During moulting the BW of birds shows declining trend, especially at the end of fasting. It shows the loss of BW especially liver, ovary and oviduct. The higher weights were noted in medium (16%) and low (14%) proteins with low energy (2700kcal/kg) as well as corn based rations. The BW appears to be influential in the achievement of effective results following an induced moult procedure (Wolford, (1984). It has been suggested that specific BW must be achieved during fasting to realize optimal PM performance from single comb white leghorn hens (Brake & McDaniel, 1981ab). The BW reduction in the current trial was shown to be 27%. Therefore, it can be suggested that the termination of fasting should be determined on BW basis rather than days-of-fasting. Similarly, Wolford (1984) reviewed that only after BW reached its original level egg production increased to relatively high rates.

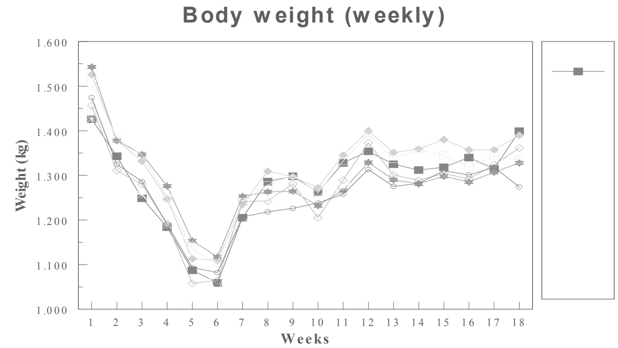

Figure 1: Weekly body weight of moulted flock

The weight reduction in the current trial was 27%. However, Cunningham and McCormick (1985) obtained comparable results with BW reduction ranging between 14-16 or 25-30%. Whereas, Shipee *et al.* (1979) found

Table I. Composition of experimental rations and ration no. 3

INGREDIENTS	RATIONS (%)							
	A	B	C	D	E	F	G	H*
Corn	100	21	40	22	31	26	40	40
Rice Broken	-	44	24	38	28	29	14	17
Rice Polishing	-	5	5	5	5	5	5	6
Wheat Bran	-	3	3	3	3	3	3	2
Cottonseed meal	-	4	4	4	4	4	4	4
Rapeseed meal	-	4	4	4	4	4	4	5
Corn Gluten 30%	-	5	5	5	5	5	5	2
Corn Gluten 60%	-	-	-	-	-	-	-	5.3
Fish meal	-	-	-	-	-	-	-	6
Blood meal	-	-	-	-	-	-	-	1
Sunflower meal	-	7	5.5	5	1	4	1	3
Soybean meal	-	2	3	9	12	15.2	17.2	-
DI-Calcium Phosphate	-	1.2	1.2	1.2	1.2	1.1	1.1	0.7
Limestone	-	1.3	1.3	1.3	1.3	1.2	1.2	4.5
Molasses	-	2	2	2	2	2	2	2
Soybean oil	-	-	1.5	-	2	-	2	1
Vitamin mineral Premix	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Chemical Composition (%)								
Crude Protein	9	13.98	13.95	16	16	18.00	17.91	17
Metabolizable Energy (K cal/ Kg)	3400	2722	2901	2707	2898	2701	2904	2900
Crude fiber	2.49	4.43	4.55	4.69	4.48	5.08	4.99	3.79
Calcium	0.02	0.83	0.82	0.84	0.84	0.80	0.79	2.05
Phosphorus	0.08	0.29	0.30	0.31	0.32	0.31	0.31	0.33

Note = * Where H stands for Ration no. 3 (Layer mash) no difference in performance of hens reaching 20 or 25% BW loss and a decrease in performance.

Reproductive Organs Weight and Length. The reproductive organs (ovary, oviduct) were calculated as per 100 g dressed weight (DW); DW was also calculated on each slaughter.

The ovary and oviduct weight both did not vary (P>0.05) among moult diets varying in CP and ME contents, both at PM and 50% P stages (Table II). Whereas between stages the ovary (2.14 g/100g BW) and oviduct (4.20 g/100g BW) weights were maximum (P<0.05) at 50%P stage, in contrast to PM stage, where the ovary (0.31 g/100g BW) and oviduct (0.84 g/100g BW) weights were minimum. Reproductive tract length (RTL) was also noted both at PM and 50% P stages. At PM stage, highest (P<0.05) RTL (54 cm) was noticed with the diet having 18% CP, 2900 kcal/kg ME, while no significant differences exists among other diets (Table II). However, at 50% P stage the highest (P<0.05) RTL (62.67 cm) was observed in the birds having corn (10% CP, 3400 kcal/kg ME), while lowest (P<0.05) RTL (32.00cm) with 18% CP, 2900 kcal/kg ME. Between stages the highest (P<0.05) RTL (53.00cm) was noted at 50%P stage then PM stage (28.90cm).

Ovary, oviduct weight and RTL increased significantly after PM upto 50%P, because after PM all the birds were provided with *ad-libitum* layer mash ration. Brody *et al.* (1980) stated that the birds fed *ad-libitum* showed accelerated development of reproductive tract. These increases show that birds after moulting start to reconstruct its reproductive system and reach the limit to potentate the egg production. During fasting much of the ovary and oviduct weight loss occurs and afterwards during post-fast-pre-lay interval further loss also had been noticed. Gilbert and Blair (1977) explained it as the force moulted hens achieved an ovary and oviduct size, which corresponds to a sexually immature pullet.

The weights of the ovary and oviduct were significantly influenced by force moulting (Roland & Brake, 1982) and decreased markedly for the first two weeks of food restriction but thereafter weight changes in these organs were small. The major cause of any further BW loss would therefore have been reductions in carcass fat or lean body tissue (Rose & Campbell, 1986). In this trial, the weight reduction was found to be 80 and 65% in ovary and oviduct weights, respectively. It has been shown that reproductive tract regression was positively associated with attainment of a lean body mass and maximum involution of ovary and oviduct, during fast (Brake & McDaniel, 1981b).

Per cent Hen-Day Egg Production. Maximum (P<0.05) % hen-day egg production (62.67%) was shown by the birds having diet with 16% CP, 2900kcal/kg ME, and minimum (45.83%) with 18% CP, 2900kcal/kg ME (Fig. 2).

Among weeks, highest (P<0.05) % hen day egg production was observed at 11^{th} and 12^{th} week. As mentioned earlier, medium (16%) protein, high energy (2900 kcal/kg) group shows the significantly lower BW, as compared to the high (18%) protein and high energy ration, just after moulting. This group with the lean body (less BW gain) shows the maximum PM egg production, reflecting relationship of lean body weight or indirectly lower body fat with higher egg production. The group having high protein and high energy diet, gain more weight, most of which deposits in the form of fat in the body, Hence showing lower production potential. The results of present study were generally in agreement with Brake *et al.* (1979), Harms (1983), Koelkebeck *et al.* (1991) and Koelkebeck *et al.* (1993). They pointed out

Table II. Effects of diets varying in protein and energy levels on ovary and oviduct weight and reproductive tract length at different stages in induced moult commercial layers

Slaughter Parameters			Treatments							
		CP →	10	14	14	16	16	18	18	
	Stage	ME →	3400	2700	2900	2700	2900	2700	2900	Stages
Ovary Weight[1]	PM		0.22	0.33	0.27	0.31	0.26	0.17	0.58	0.31^b
	50%		1.84	1.46	2.23	1.79	3.07	1.93	2.67	2.14^a
Oviduct Weight[1]	PM		0.73	0.84	0.44	0.64	0.66	0.70	1.87	0.84^b
	50%		4.51	4.95	4.16	3.48	4.39	4.31	3.58	4.20^a
RTL[2]	PM		27.00^b	28.33^b	20.67^b	25.67^b	24.33^b	22.33^b	54.00^a	28.90^b
	50%		62.67^a	58.33^{ab}	47.33^b	56.67^{ab}	56.67^{ab}	57.33^{ab}	32.00^c	53.00^a

Note =Means with the different superscripts in the same row differs significantly at P<0.05, while in stages the mean with the same superscript in the same column differs non-significantly.

PM= Post-moult; 50%= 50% production stage; CP= Crude protein; ME= Metabolizable energy; RTL= Reproductive tract length.

1= Mean expressed as g/100g body weight; 2= Mean expressed in cm

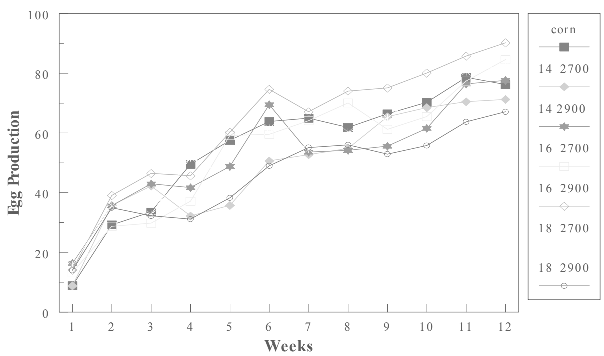

Figure 2: Percent hen-day egg production of moulted flock

that hens fed a 16% CP moult diet regain BW faster and return to egg production more rapidly than a diet containing 8-10% CP.

CONCLUSIONS

For high per cent hen day egg production, it has been found that birds should have lean BW, to rejuvenate their reproductive tract more efficiently. The bird having 16% CP and 2900 kcal/kg shows lower BW gain along with maximum production. There is the need for evaluating the effects of corn fortification, with different amino acids to improve its protein content as a moult diet, on PM egg production in our local conditions. Also, in the PM production period, exploitation of different protein and energy levels should have to be given due consideration for the future research.

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