Research Article

EFFECT OF BODY WEIGHT ON FEED INTAKE OF PULLETS AT THE ONSET OF LAY

Şahin ÇADIRCI[1]

ABSTRACT
An experiment was conducted to investigate the effect of body weight on feed intake of pullets at the onset of lay. One hundred and thirty two Nick Brown Pullets were grouped into two according to their body weight, and caged singly. The range of body weight for the light and heavy groups was 1481 g to 1616 g, and 1617 g to 1752 g, respectively. Daily feed intake patterns of the two body weight groups were recorded in association to the onset of egg production, i.e. 5 days prior to, 5 days after and at initial oviposition. The differences in body weight were found to be related to daily feed intake of pullets at the onset of lay, moreover, daily feed intake increased with increasing body weight. These data indicate that average flock consumption is a poor indicator of consumption for birds of different body weight at the onset of lay.
Key words. Pullets; Body weight; Feed Consumption; Onset of Lay

YUMURTLAMA PERİYOTU BAŞLANGIÇINDAKİ YARKALARDA CANLI AĞIRLIĞIN YEM TÜKETİMİ ÜZERİNE ETKİSİ

ÖZET
Yapılan bu çalışmayla, yumurta başlanğıcındaki yarkalarda, canlı ağırlığın yem tüketimi üzerine etkisi incelenmiştir. 132 adet Nick Brown yarka canlı ağırlıklarına göre gruplandırıldı ve bireysel kafeslere yerleştirildi. Hafif ve ağır grup yarkalara ait canlı ağırlıklar sırasıyla hafif grupta 1481 g ile 1616 g, ağır grupta ise 1617 g ile 1752 g arasında değere sahiptir. Her iki canlı ağırlık grubunun günlük yem alım biçimleri yumurtlama başlangıcıyla ilişkilendirilerek kaydedildi, yani 5 gün öncesi, 5 gün sonrası ve ilk yumurtlama günü. Yumurtlama başlangıcındaki yarkaların günlük yem tüketimleri ile canlı ağırlık farklılıkları arasında ilişki bulunup, buna ek olarak canlı ağırlıktaki artış ile birlikte günlük yem tüketimi arttı. Bu veriler göstermektedir ki sürü ortalaması yem tüketimi, sürüdeki farklı canlı ağırlıktaki bireylerin yumurtlama başlangıcından zirve üretimine gerekli yem tüketimi için zayıf bir göstergedir.
Anahtar sözcükler: Canlı ağırlık; Yem tüketimi; Yarka; Yumurtlama başlanğıcı

[1]Department of Animal Science, Faculty of Agriculture, Harran University, Sanliurfa, Turkey

INTRODUCTION

A significant amount of research has been undertaken to study feeding programs for egg production type pullets at the point of lay. Yet, there does not appear to be an agreement on the proper levels of dietary nutritions required at the onset of lay (Leeson and Summers, 1997). A common view in today's pullet feeding is to offer nutrients based on the average feed intake of the flock (Harms et al., 1978; NRC, 1994) eventhough flocks are rarely uniform in their needs. It is known that once egg production begins, small birds remain small and large birds remain large throughout the laying cycle and birds of different body weight have different feed intake (Harms et al., 1982). In addition, developing pullets have lower nutrient requirements than laying hens (Harms and Douglas, 1981; Leeson and Summer, 1982; Maurice et al. 1982; Sloane et al. 1992). Consequently, the mean value for feed intake is often misleading and it is difficult to match nutrient intake correctly to the requirements of all birds in the flock. Therefore, this criterion becomes critical in the assessment of nutritional status. The diet must contain an adequate concentration of nutrients if the smaller birds in the flocks are going to be expected to perform to their full genetic potential throughout the laying cycle and, in turn, be a profitable flock. It has previously been suggested (Quisenberry et al. 1967; Thornberry et al. 1968; Bell 1968; Leeson and Summers 1987) that, in order to obtain more uniform flocks, pullets should be housed based on body weight (BW), i.e. their nutrient requirement. Thus optimum peaks in egg production can be reached in light birds. Our study intended to investigate the effect of body weight on feed intake of pullets 5 days prior to initial oviposition, at initial oviposition and 5 days post initial oviposition.

MATERIALS AND METHODS

One hundred and thirty two Nick Brown pullets of eighteen weeks of age, were randomly placed individually in one of two body weight groups (BWG): light and heavy. The birds were individually weighed at the beginning of the experiment. The range of body weight for the light and heavy groups was 1481 g to 1616 g, and 1617 g to 1752 g, respectively. Temperature control system of the house was set to maintain a daily average of 23±2°C by controlling the two air conditioners (White Westinghouse). The birds were kept in a windowless house and given conventional artificial light. Light was supplied by 40 Watt tungsten bulbs. The ingredients used and the calculated nutrient content of the diet formulations used in this study are shown in Table 1.

Table 1. Composition of experimental diet.
Çizelge 1. Deneme yem bileşimi.

Ingredient composition	g/kg
Maize (7.57 CP) [3]	616.60
Soybean meal(48.07 CP) [3]	245.10
Maize Oil	32.40
Limestone	83.70
Dicalcium phosphate [2]	14.80
NaCl	4.00
Vitamin-mineral premix [1]	2.50
Dl-Methionine	0.80
Calculated nutrient composition	
Crude protein [4]	165.00
Calcium[5]	36.00
Available phosphorus[5]	4.00
Sodium[5]	1.80
Arginine	1.08
Lysine[5]	8.90
Methionine[5]	3.60
Methionine + cystine[5]	6.45
Threonine[5]	6.37
Tryptophan[5]	2.18
Apparent Metabolizable Energy (AME) [MJ/kg] [5]	12.14

[1] The composition of vitamins and minerals in the premix provided the following amounts per kilogram of diet: Vit A 12 000IU, Vit D_3 2 500IU, Vit E 30mg, Vit K_3 4mg, VitB_1 3mg, Vit B_2 7mg, Vit_6 5mg, VitB_{12} 0.015mg, VitC 50mg, Niacin 30mg, Calpan 10mg, Biotin 0.045mg, Folic Acid 1mg, Choline Chloride 200 mg, Canthaxanthin 2.5mg, Apo-Carotenoic Acid Ester 0.5mg, Manganese 80mg, Iron 60mg, Zinc 60mg, Copper 5mg, Iodine 1mg, Cobalt 0.2mg, Selenium 0.15mg, Antioxsidant 10mg.

[2] The composition of dicalcium phosphate provided the following amounts per kilogram of diet: Ca 23% and P 20%.

[3] Result of analysis

[4] Based on analysis of maize and soybean meal.

[5] Based on NRC 1994 values for maize and soybean meal

The nutrient specifications were set to meet or exceed (NRC 1994) nutrient requirements at this stage. One feed-trough were located at the front of each cage. Each day, the hens were allocated enough feed (250 g) to exceed the expected daily feed intake for hens of this age and strain. Feed and water were consumed *ad libitum*. For each bird feed consumption was recorded daily during a 21 day experimental period. Birds that initiated lay before 5 days or after 16 days into the experimental period were not used in comparisons. Individual egg records were maintained and feed consumption was calculated for the 5 days prior to initial oviposition, the day of initial oviposition, and the 5 days post initial oviposition. The 5 days post initial oviposition were also examined for feed consumption patterns according to whether or not an individual bird produced an egg on any of those 5 days. For this, each of the 5 days post oviposition 35 birds from both body weight groups were selected randomly. In addition, feed consumption was calculated for pullets that did not initiate production by the end of the experimental period. Methods of (Sloan et al. 1992) were used for the procedure of collecting data and calculation. All data were obtained on an individual hen basis. Experimental data were subjected to statistical analysis using the analysis of variance procedures of the statistical programme SPSS for Windows (release 5.0.1, Copyright 1992) SPSS Inc. Significant differences were tested further using a Least-Significant Difference (LSD) multiple range test to determine the differences among groups.

RESULTS AND DISCUSSION

Table 2 shows the feed consumption of light and heavy body weight birds for the 5 days prior to initial oviposition, at initial oviposition and 5 days post initial oviposition. During the 5 days prior to initial oviposition, daily average consumption of birds in the light and heavy body weight groups was 88.9 g and 97.4 g, respectively, representing a significant (P<0.05) difference of 8.5 g between the two groups. In both groups a fall in feed consumption is apparent over the 5 day period immediately preceding the first egg, and this is in agreement with earlier findings by (Foster 1968). On the day of oviposition, daily average consumption for the light and heavy groups was 91.8 g and 100.4 g, respectively, showing a trend of increase by 2.9 g and 3.0 g compared to the relevant values of the 5 days prior to initial oviposition (P>0.05). When comparing feed consumption values of the two weight groups on the day of oviposition, an even more marked difference was seen: the heavy group consumed 8.6 g more feed than the light one (P<0.05).

Table 2. Average daily feed intake of pullets in different weight groups at onset of lay.
Çizelge 2. Ağırlıkları farklı yarka gruplarının yumurtlama başlangıcı ortalama günlük yem tüketimi.

Body Weight Group	Days prior to oviposition	Feed Intake	Day of initial ovipositin	Days post-ovipositin	Feed Intake
	5	96.0		1	100.9
	4	93.4		2	101.2
Light	3	90.3		3	103.6
(1556.9±5.21)	2	85.0		4	104.2
	1	79.6		5	105.4
x±sem		88.9±2.95^{a,1}	91.8±1.68^{a,1}		103.1±0.87^{b,1}
	5	103.4		1	107.0
	4	99.9		2	108.0
Heavy	3	99.6		3	108.6
(1675.8±4.90)	2	93.4		4	109.6
	1	90.9		5	111.5
x±sem		97.4±2.29^{a,2}	100.4±2.27^{a,2}		108.9±0.77^{b,2}

[a,b] Values within a row with no common superscript differ significantly (p<0.05).
[1,2] Values within a column with no common superscripts differ significantly (p < 0.05).
Feed intakes are expressed as g/day.
Data are means ± sem.

During the 5 days post initial oviposition an average of 103.1 g feed was consumed by the light and 108.9 g by the heavy group. These values are significantly greater (P<0.05) than the ovipositional values (differences being 11.3 g for the light and 8.5 g for the heavy group) and the pre-ovipositional ones (differences being 14.2 g for light and 11.5 g for heavy birds). During the 5 days post oviposition, daily average consumption for the heavy group was 5.8 g greater than the light group, a significant difference (P<0.05). These observations are supported by previous findings that non-laying birds consume less feed than birds in lay (Sloan et al. 1992) and that light birds consume less than heavy birds (Harms et al. 1982). Thus it can be suggested that feed formulated for the flock average is misleading for birds in different body weight at the onset of lay.

Daily consumption levels of light and heavy birds between days that eggs were produced and those on which eggs were not produced for the 5 days post initial oviposition were compared. Results are summarised in Table 3.

Table 3. Average feed intake of pullets in different weight groups on each of the 5 days post initial oviposition.

Çizelge 3. Ağırlıkları farklı yarka gruplarının yumurtlama sonrası 5 günlük ortalama yem tüketimi.

Body Weight Group	Days post-oviposition	Feed Intake (g) Egg (s) Produced	Egg (s) Not Produced	Difference (g)
Light (1556.9±5.21)	1	98.9 (17)	85.9 (18)	13.0
	2	99.3 (27)	82.3 (8)	17.0
	3	104.2 (29)	89.2 (6)	15.0
	4	102.7 (31)	86.3 (4)	16.4
	5	101.5 (33)	81.0 (2)	20.5
x±sem		$101.3 \pm 1.00^{a,1}$	$84.9 \pm 1.47^{b,1}$	
Heavy (1675.8±4.90)	1	98.8 (17)	93.7 (18)	5.1
	2	103.3 (27)	95.0 (8)	8.3
	3	105.1 (29)	99.7 (6)	5.4
	4	105.9 (31)	98.0 (4)	7.9
	5	107.6 (33)	94.0 (2)	13.6
x±sem		$104.1 \pm 1.50^{a,1}$	$96.1 \pm 1.18^{b,2}$	

^{a,b} Values within a row with no common superscript differ significantly (p<0.05).
^{1,2} Values within a column with no common superscripts differ significantly (p < 0.05).
Values in parentheses show the number of observations used to calculate the average.
Feed intakes are expressed as g/day.
Data are means ± sem.

In both body weight groups, difference in feed intake was the greates at the maximum rate of lay (20.5 g for light and 13.6 for heavy birds). In addition, difference in average feed consumption between the days that eggs were produced and not produced for the light group (16.4 g) was more than two-fold of the value obtained from the heavy group (8.1 g). Light pullets that did not initiate egg production during this study consumed an average of 27.3 g less feed than birds that did initiate production (74.0 g vs 101.3 g) during the 5 days post initial oviposition. When similar comparision was made in the heavy group, difference was found to be 17.7 g (86.4 g vs 104.1 g). These data also indicate that flock consumption average is a poor indicator of consumption for individual laying hens differening in production and body weight.

Taking a dynamic view of the process (initial oviposition to peak production), it can be stated that heavy birds and laying birds consume significantly more feed than their light or non-laying counterparts, respectively. Moreover, there is a significant increase in feed consumption with time in lay. These findings indicate that average feed consumption might not be a reliable measure for the consumption of individual birds at the onset of lay and the days after. (Harms and Douglas 1981) recommended that the percentage of the nutrients in the feed should be changed when the feed intake of the flock is changed. The basic concept is that high daily feed consumption permits low nutrient concentrations and low daily feed consumption demands high nutrient concentrations (NRC 1994). This would be of economic importance in feed formulation, since the nutrient composition of the feed for each group could be adjusted to meet the daily requirement for all nutrients. However, when egg producers purchase their replacement pullets from commercial growers, pullets are not uniform. This can be most damaging to underweight individuals (Leeson and Summers 1997) if providing them with the average feed, and optimum peaks in egg production are seldom seen with light birds due to energy deficiency (Leeson and Summers 1997). In contrast, if the flock is divided into groups uniform in body weight, such poblems can be partly over come.

CONCLUSION

In practice, diets for laying hens can be most accurately formulated on the basis of feed intake data obtained for uniform (light or heavy) flock averages (NRC 1994). If the producers keep this fact in mind, cost savings can be achieved. Firstly, seperating birds according to body weight allows a higher level of energy to the light birds and energy deficiencies of light birds at peak production may be minimised. Secondly, since especially protein sources are expensive, a more uniform flock allows decreased margin safety of feed construction.

All aspects of layer flock manegement and nutrition offer opportunities for investigation into feeding according to body weight of the birds. Future investigations may expand the understanding of the effect of different body weight and various levels of nutrition density on egg production throughout the laying cycle.

ACKNOWLEDGEMENT

I wish to thank the University of Harran for financial support and facilities. I also thank K. Vajda for her general comments.

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