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# Effects of Supplemental Fat on Performance of Laying Hens

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**Abstract:** 360 Hy-line W36 hens were fed the diets with four different levels of fat (0, 1.5, 3.0 and 4.5%) to determine different levels of supplemental fat on performance of laying hens from 35 to 44 week of age. Hy-line W-36 hens at 35 week of age were randomly assigned into 4 dietary treatments (6 replicates of 15 birds per treatment). As fat level increased, feed intake linearly decreased from 99.1 to 93.5, resulting a 5.7% decrease in feed intake. As fat level increased, feed conversion linearly decreased. Increasing fat had no effects on egg production, egg weight, egg mass, egg specific gravity, and body weight of laying hens. Increasing fat improved nutrient (protein, amino acids, calcium, and phosphorus) utilization. It may be a good choice to supplement high level of fat to improve protein (amino acids) utilization and to decrease cost of production especially when fat price is cheap and prices of protein source ingredients are expensive.

**Key words*:*** Supplemental fat, feed conversion, egg weight

## Introduction

Feed intake is an important factor in formulating the diets. Regulating dietary energy by supplementing fat is believed to be one of the most effective ways to adjust feed intake of laying hens. Several studies (Grobas *et al*., 1999a, 1999b; Harms *et al*., 2000; Bryant *et al*., 2005) showed that increasing dietary energy or supplementing fat decreased feed intake and improved feed conversion of laying hens (Bryant *et al*., 2005; Wu *et al*., 2005b,c).

Egg weight can be increased by increasing protein (Liu *et al*., 2005; Wu *et al*., 2005a), methionine (Keshavarz, 1995), lysine (Novak *et al*., 2004; Liu *et al*., 2005), supplemental fat (Grobas, 1999a, 1999b; Sohail *et al*., 2003), and dietary energy (Keshavarz, 1995; Keshavarz and Nakajima, 1995; Bryant *et al*., 2005). The effects of protein and amino acids have been well understood. However, there are inconsistent results in effect of supplemental fat or dietary energy on egg weight. Summers and Leeson (1983, 1993) reported that supplementing fat in diets or increasing dietary energy had no effect on egg weight.

Egg production can be affected by protein (Liu *et al*., 2005), lysine (Wu *et al*., 2005a), and supplemental fat (Grobas *et al*., 1999a). There are contradicted results about the effect of supplemental fat on egg production. The addition of fat had no effect on egg production (Harms *et al*., 2000; Bohnsack *et al*., 2002; Sohail *et al*., 2003; Bryant *et al*., 2005).

Many egg producers do not use supplemental fat because of inadequate storing and mixing facilities (Sohail *et al*., 2003). Supplementing fat in diets can increase feed efficiency (Bryant *et al*., 2005; Wu *et al*., 2005b). If the fat price is cheap, the addition of fat may reduce the cost. However, few studies have been conducted to investigate different levels of supplemental fat on performance of laying hens. It is necessary for commercial Leghorn industry to understand the effect of different levels of supplemental fat on performance of laying hens to optimize the use of supplemental fat. The objective of this experiment was to determine different levels of supplemental fat on performance of Hy-line W-36 hens from 35 to 44 week of age.

## Materials and Methods

In this experiment, 360 Hy-line W-36 hens at 35 week of age were randomly assigned into 4 dietary treatments (6 replicates of 15 birds per treatment). Ingredients and nutrient composition of experimental diets were showed in Table 1. Hens were fed the diets with four different levels of fat (0, 1.5, 3.0, and 4.5%) for 10 weeks. Hens were kept in an environmentally controlled house where daily house temperature was maintained at 27$^{o}$C. Three hens were housed in a 42 × 46 cm$^2$ cage and five adjoining cages consisted of a replicate. Hens in each replicate shared a feed trough and had access to drinking cups. A standard lighting program (16 hour light: 8 hour dark) was used. Feed consumption was obtained weekly by subtracting the ending feed weight in trough from the beginning feed weight. Egg production was recorded weekly. Egg weights were determined weekly using all eggs laid for two consecutive days. Egg specific gravity was determined monthly using all eggs laid for two consecutive days (Holder and Bradford, 1979). Mortality was determined daily. Body weight was obtained by weighting hens at the end of experiment.

Data were subjected to one-way ANOVA by using general linear model procedure in Statistical Analysis System (SAS Institute, 2000). If differences in treatment means were detected by ANOVA, Duncan's Multiple Range Test was applied to separate means. Statements of statistical significance are based on a probability of ($P \leq 0.05$).

Table 1: Ingredients and nutrient composition of experimental diets

| Ingredient | Diet 1 | Diet 2 | Diet 3 | Diet 4 |
|---|---|---|---|---|
| Corn (%) | 66.89 | 65.16 | 63.51 | 61.84 |
| Soybean meal (%) | 21.58 | 21.80 | 21.95 | 22.10 |
| $CaCO_3$ (%) | 5.13 | 5.13 | 5.12 | 5.12 |
| Hardshell[1] (%) | 4.00 | 4.00 | 4.00 | 4.00 |
| Dicalcium phosphate (%) | 1.49 | 1.49 | 1.50 | 1.51 |
| Poultry fat (%) | 0.00 | 1.50 | 3.00 | 4.50 |
| NaCl (%) | 0.35 | 0.35 | 0.35 | 0.36 |
| Vitamin premix[1] (%) | 0.25 | 0.25 | 0.25 | 0.25 |
| Mineral premix[2] (%) | 0.25 | 0.25 | 0.25 | 0.25 |
| DL-Methionine (%) | 0.06 | 0.07 | 0.07 | 0.07 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 |
| Calculated analysis | | | | |
| Crude protein (%) | 15.7 | 15.7 | 15.6 | 15.6 |
| ME (kcal/kg) | 2767 | 2844 | 2922 | 2999 |
| Ca (%) | 4.00 | 4.00 | 4.00 | 4.00 |
| Available phosphorus (%) | 0.37 | 0.37 | 0.37 | 0.37 |
| Methionine (%) | 0.33 | 0.33 | 0.33 | 0.33 |
| Metionine+Cystine (%) | 0.60 | 0.60 | 0.60 | 0.60 |
| Lysine (%) | 0.81 | 0.81 | 0.81 | 0.81 |

[1]Provided per kilogram of diet: vitamin A, 8,500 IU; cholecalciferol, 2,200 ICU; vitamin E, 8 IU; vitamin $B_{12}$, 0.02 mg; riboflavin, 5.5 mg; D-calcium pantothenic acid, 15 mg; niacin, 36 mg; choline, 500 mg; folic acid, 0.5 mg; vitamin $B_1$, 1 mg; pyridoxine, 2.2 mg; biotin, 0.05 mg; vitamin K, 2 mg. [2]Provided per kilogram of diet: manganese, 66 mg; iodine, 1 mg; iron, 55 mg; copper, 6 mg; zinc, 57 mg; selenium, 0.3 mg.

## Results and Discussion

As fat level increased from 0 to 4.5%, feed intake linearly decreased from 99.1 to 93.5, resulting a 5.7% decrease in feed intake (Table 2). This result was in agreement with that of Grobas *et al*. (1999a, 1999b), Sohail *et al*. (2003), and Bryant *et al*. (2005), who reported that supplemental fat had a significant effect on feed intake. In winter, except controlling environmental temperature, supplementing fat in diets may be an effective way to adjust feed consumption of hens.

Increasing fat had no significant effect on egg production. This result was consistent with that of Harms *et al*. (2000), Bryant *et al*. (2005), and Wu *et al*. (2005b), who reported that egg production was not affected by supplemental fat or dietary energy. However, Grobas *et al*. (1999a) reported that supplemental fat increased egg production from 38 to 61 wk of age. Weight gain of hens fed the diets supplemented with fat was significantly higher than that of hens fed the diets without fat (Grobas *et al*., 1999a). In this experiment, there was no significant difference in body weight among hens fed four diets. The difference in body weight or weight gain of hens among researchers might explain the inconsistent results in the effect of supplemental fat on egg production.

Increasing supplemental fat had no significant effect on egg weight. This result was similar to that of Summers and Leeson (1983, 1993), who reported that egg weight was affected by body weight of laying hens, rather than supplemental fat or dietary energy. In this experiment, increasing fat had no effect on body weight, which might lead to no response of egg weight to supplemental fat. However, several studies (Keshavarz, 1995; Keshavarz and Nakajima, 1995; Harms *et al*., 2000; Bohnsack *et al*., 2002; Sohail *et al*., 2003; Bryant *et al*., 2005) reported that increasing fat affected egg weight. The differences among researchers might be due to differences in strains, body weight of laying hens, and composition of fat.

There was no significant difference in egg specific gravity among hens fed four diets. Although increasing fat had no effect on egg mass, feed intake linearly decreased with increasing fat. As fat level increased, feed conversion linearly decreased. These results were in agreement with those of Bryant *et al*. (2005) and Wu *et al*. (2005b,c), who reported that increasing fat improved feed efficiency. Increasing fat improved nutrient (protein, amino acids, calcium, and phosphorus) utilization. Protein source ingredients such as soybean meal and meat bone meal are the major cost of the diets. It may be a good choice to supplement high level of fat to improve protein (amino acids) utilization and to reduce cost of production especially when fat price is cheap and prices of protein source ingredients are expensive. In this experiment, no decline of egg production and egg weight was observed as fat level increased to 4.5%. As supplemental fat increases from 4.5% to a certain level, egg production and egg weight may decrease because of decreased nutrient intake. More studies needs to be conducted to investigate higher level (more than 4.5%)

Table 2: Influences of supplemental fat on performance of Hy-line W-36 from 35 to 44 wk of age*

| Treatment | Feed intake (g/hen per day) | Egg production (%) | Egg weight (g) | Egg mass (g egg/hen per d) | Feed conversion (g of feed/of g egg) | Egg specific gravity (unit) | Body weight (kg) |
|---|---|---|---|---|---|---|---|
| Diet without fat | 99.1[ab] | 86.3 | 58.90 | 50.82 | 1.95[a] | 1.0807 | 1.55 |
| Diet with 1.5% fat | 100.3[a] | 87.5 | 59.34 | 51.88 | 1.93[a] | 1.0802 | 1.63 |
| Diet with 3.0% fat | 96.5[bc] | 85.8 | 58.83 | 50.44 | 1.91[a] | 1.0800 | 1.56 |
| Diet with 4.5% fat | 93.5[c] | 86.6 | 58.67 | 50.82 | 1.84[b] | 1.0800 | 1.60 |
| Pooled SEM | 1.05 | 1.04 | 0.23 | 0.55 | 0.02 | 0.0003 | 0.05 |
| Probability | 0.0077 | NS | NS | NS | 0.0283 | NS | NS |
| Contrast (Fat linear effect) | 0.0063 | NS | NS | NS | 0.0023 | NS | NS |

[a-c] Means within a column and under each main effect with no common superscripts differ significantly.
Statements of statistical significance are based on a probability of ($P \leq 0.05$).

of fat effect on performance of laying hens.

In conclusion, increasing fat linearly decreased feed intake and feed conversion while increasing fat had no effects on egg production, egg weight, egg mass, egg specific gravity, and body weight of laying hens. Increasing fat improved nutrient utilization of protein (amino acids), calcium, and phosphorus.

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