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EFFECT OF DEHYDRATED ALFALFA AND AGE ON EGG WEIGHT, EGG MASS, FEED INTAKE, AND FEED CONVERSION EFFICIENCY IN HY- LINE®W-98 LAYERS

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ABSTRACT

In a trial conducted with laying hens, four levels (4, 8, 12 and 16%) of locally dehydrated alfalfa meal (LDAM) as assigned treatments: T1, T2, T3 and T4 respectively were used in rations for six hundred Hy- Line®W-98 layer hens for 20 weeks, to test the effect of (LDAM) and age on egg weight, egg mass, feed intake and feed conversion efficiency. Non significant effects of treatments were observed on egg weight. Significant low egg mass was observed with high levels (8% or more) of LDAM. Age significantly ($P \leq 0.05$) influenced egg weight, and egg mass, both significantly increased as hens´ age increased. Treatments and age periods significantly ($P \leq 0.05$) affected feed intake (FI) and feed conversion efficiency (FCE). With increasing alfalfa meal levels and birds' age FI increased, while FCE decreased.

Key words: dehydrated alfalfa, age, egg weight, egg mass, feed intake, feed conversion efficiency

INTRODUCTION

Hens' eggs represent natural, concentrate and complete human food. An egg covers about 13.3% of an adult and nearly 25% of a child's daily requirements of protein, its high biological value and easy digestibility add to its assets. Egg size and weight and the inner contents of the egg are important economic factors, which have an effect on the total inputs of poultry projects. Customers with qualitative demands have compelled producers to focus on both qualitative and quantitative features of eggs to obtain high level profits. Feed costs constitute about 65% of total egg production cost; see Rose (1997). It is required to search for new local resources of feedstuffs. This means that new feed resources are those which have not been used as commercial feedstuffs; see Leeson and Summers (1997).

Common alfalfa *(Medicago sativa*) grows widely in the USA, EU countries, and South Eastern Asia. It is a perennial and herbal legume plant which can stay in the soil for more than 10 years, in Iraq not more than 4-5 years. Alfalfa is a good local feedstuff, but has not been used as commercial feed in poultry nutrition in Iraqi Kurdistan before. Two types of dehydrated alfalfa meal (DAM); artificially dehydrated by heat, and sun (sun-cured) were available. There are three kinds of DAM; first: dehydrated alfalfa leaf meal (20% crude protein), second: dehydrated alfalfa leaf and stem meal (17% crude protein), third: dehydrated alfalfa stem meal (13% crude protein); Titus and Fritz (1971). Alfalfa is well balanced in amino acids and rich in vitamins, carotenoids, and xanthophylls (Sen *et al*., 1998; Ponte *et al*., 2004).

Dehydrated alfalfa leaf meal (20% crude protein) is more convenient for chicken feeding than others considering the high rate of protein and low in fibre content. Green fresh alfalfa contains 73% water, 5.2% crude protein, 0.8% fat, 7.4% fiber, 2.06% ash, 10.4% nitrogen free extract (NFE); see Titus and Fritz (1971). DAM contains 18-20% crude protein, 400-550 mg/kg xanthophylls and 200000 IU vitamin A; see Leeson and Summers (1997). It is a good source of vitamins, especially E and K; see Titus and Fritz (1971). Alfalfa

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leaf contains 2-3% saponin; see Story (1984). In large quantities, however, it has a toxic effect; the intake of large amounts may cause blood haemolysis. Feeding chicken with more than 20% DAM may induce trouble due to saponins, especially through physiological effects, including haemolysis, growth inhibition, decrease of feed intake and feed conversion efficiency; see Patrick and Schaible (1980). Feeding 0.05% saponin did not induce negative effects on feed conversion efficiency on New Hampshire chicks; see Anderson (1957).

Body weight is an important measurement in poultry production; see North (1984). Body weight and egg weight are two productive parameters that are highly correlated coefficients. Egg weight increases with bird's age; see (North, 1984; Sturkie, 1986). Egg weight, mass and production are affected by several environmental factors especially nutrition and age; see (North, 1984; Austic and Nesheim, 1990). Feeding rations containing 50% DAM decreased egg production; see Weiss and Scott (1979).

Egg weight is affected by genetic factors, age and nutrition. Deficiency of essential amino acids decreased egg weight. Increasing protein levels in the ration increased egg weight; see Gardner and Young (1972). Increasing the rate of lysine in the diet of Hy-Line W-36 layers (42 weeks of age) to 1.15% did not significantly affect egg production, whereas an increase of lysine rate to 1.37% decreased egg production; see Prochaska *et al*. (1996). Egg weight increased with age; see Anderson *et al*. (1978), Stadelman and Cotterill (1995). Feed intake and the coefficient of feed conversion are significantly affected by DAM rate in layers' rations; see McNaughton (1978), Pederson *et al*. (1972). Feeding New Hampshire layers with rations containing 0.05% saponin had no effect on the coefficient of feed conversion, whereas 0.1% saponin had; see Anderson (1957). Feed intake increased when rations contained high levels (50%) of DAM; see Weiss and Scott (1979), Han and Parsons (1990). Feed conversion efficiency was decreased with age increment; see Scott *et al.* (1982).

MATERIALS AND METHODS

The experiment was carried out in a commercial poultry project – Erbil and in the nutrition laboratory of the Agriculture College/ University of Salahaddin-Erbil. The study comprised an investigation on the effect of using four levels of locally dehydrated alfalfa meal (LDAM); (Table 1) compared with the control and age on egg weight, egg mass, feed intake, and feed conversion efficiency. Six-hundred of Hy- Line®W-98 layer hens (36 weeks old) were used for 20 weeks. Layers were housed in an automatically controlled house and reared in 3 caged batteries (45×40×45 cm) for each cage. They were distributed randomly in five groups; each group contained 120 birds distributed in 24 cages (4 replications × 6 cages × 5 birds).

Table 1: Rations composition used

Treatments / Feedstuffs	T1	T2	T3	T4	C
	%				
Dehydrated Alfalfa (DAM)	4.000	8.000	12.000	16.000	0.000
Wheat	14.110	9.744	5.194	3.204	18.270
Barley	50.000	50.000	50.000	48.000	50.000
Wheat Bran	4.835	4.835	4.835	4.835	4.835
Soybean Meal	14.200	13.750	13.360	12.720	14.700
Limestone	9.100	9.000	8.900	8.700	9.331
Lysine	0.070	0.000	0.000	0.000	0.141
Methionine	0.100	0.090	0.080	0.080	0.114
Dicalcium Phosphate	1.000	1.000	1.000	1.000	0.950
Fat vegetable	2.040	3.040	4.100	4.950	1.103
Salt	0.344	0.340	0.330	0.310	0.355
Vitamins* (Cx-Layer)	0.025	0.025	0.025	0.025	0.025
Enzymes (Avienzyme1200**)	0.080	0.080	0.080	0.080	0.080
Choline	0.046	0.046	0.046	0.046	0.046
***Minerals	0.050	0.050	0.050	0.050	0.050

*Vitamins are: Pantothenic acid, Niacin, Folic acid, B_{12}, B_6, B_2, B_1, D_3, A, K_3, E, and Biotin
**Enzymes are: (Xylanase and β-Glucanase)
***Minerals are: Mn, Fe, Cu, Zn, I, Se

Table 2: Chemical Analysis of Rations

Nutrients \ Treatments		T1	T2	T3	T4	C
Kcal ME / Kg Diet		2528	2506	2484	2462	2550
Crude Protein	%	15.2	15.2	15.2	15.2	15.2
Crude Fibre	%	6.17	7.06	7.96	8.78	5.27
Ca	%	3.7	3.7	3.7	3.7	3.7
P	%	0.35	0.35	0.35	0.35	0.35
Lysine	%	0.81	0.805	0.856	0.902	0.817
Methionine +Cystine	%	0.58	0.579	0.577	0.585	0.586
Na	%	0.17	0.17	0.17	0.17	0.17
ME/P		16903	16409	16304	16200	16708

Five types of rations (treatments) were prepared containing 4, 8, 12 and 16% of LDAM and the fifth contained no LDAM and was used as control group C (Table 1). Birds were fed *ad libitum*, and at the end of the week remaining diets were collected and weighed to determine the daily feed consumption. The experimental period was 140 days, divided into five periods (P1, P2, P3, P4 and P5) of 28 days each. The daily lighting period was 17 hours with a light density of 10 lux. Dehydration process of locally green alfalfa dehydration was performed in a closed poultry pen of the Erbil project. Chemical analyses were carried out according to A.O.A.C.1975 (see AOAC 1984). Chemical analysis of green locally alfalfa revealed: moisture (75.4%), dry matter (24.6%), crude protein (5.11%), crude fat (0.7%), crude fibre (7.02%), ash (2.82%) and NFE (8.95%), whereas after dehydration the following parameters were recorded: moisture (8.5%), dry matter (91.5%), crude protein (19%), crude fat (2.6%), crude fibre (26.1%), ash (10.5%), and NFE (33.3%). Birds were fed with iso-nitrogenic and iso-caloric diets (Table 2).

Statistical analyses were carried out by a factorial experiment conducted in C.R.D. with a model equation

$$Y_{ijk} = \mu + T_i + P_j + e_{ijk},$$

where: Y_{ijk} = is the kth observation of level ith treatment, and jth period, μ= overall mean, T_i = ith treatment effect (i = 1, 2, 3, 4 & 5), P_j = jth period effect, (j = 1, 2, 3, 4 & 5), e_{ijk} = random experimental error, with normal distribution of zero mean and standard deviation of δ. Differences among mean values were compared by Duncan Multiple Range Test; see Duncan (1955) with 5% level of probability. Data were analyzed using the GLM procedure of SAS software; see SAS (1996).

The purpose of this study was to employ variable levels of LDAM and age periods of six hundred (Hy-Line®W-98) layer hens for 20 weeks and investigate their effects on egg weight, egg mass, feed intake and feed conversion efficiency.

RESULTS AND DISCUSSION

Egg weight was not significantly affected by treatments, whereas treatments had significant ($P \leq 0.05$) effects on egg mass. The highest egg mass was observed in both T1 and C groups, with significant differences between both treated and untreated groups (Table 3). These results are in agreement with those of

Table 3: The effect of nutrition on egg weight, egg mass, feed intake and feed conversion efficiency

Treatments	Characteristics			
	Egg Weight (g)	Egg Mass (g/day)	Feed Intake (g/day)	Feed Conversion Efficiency
T1	62.46 ± 0.43a*	53.29 ± 0.37a*	106.32 ± 0.77a*	1.9956 ± 0.011a*
T2	62.49 ± 0.38a	51.89 ± 0.42b	108.00 ± 0.90b	2.0829 ± 0.019b
T3	62.23 ± 0.34a	51.83 ± 0.56b	108.61 ±1.01b^{c}	2.0979 ± 0.019b
T4	62.76 ± 0.28a	51.70 ± 0.26b	109.30 ± 0.86c	2.1146 ± 0.17b
C	62.42 ± 0.48a	53.35 ± 0.50a	105.53 ± 0.74a	1.9801 ± 0.016a

*Treatment means within traits followed by different letters differ significantly ($P \leq 0.05$) from each other Duncan (1955)

Table 4: The effect of age periods on egg weight, egg mass, feed intake and feed conversion efficiency

Periods in weeks	Characteristics			
	Egg Weight (g)	Egg Mass (g/day)	Feed Intake (g/day)	Feed Conversion Efficiency
P1 (36-39)	60.30 ± 0.18a*	50.97 ± 0.40a*	102.24 ± 0.43a*	2.008 ± 0.017a*
P2 (40-43)	61.37 ± 0.19b	51.85 ± 0.32abd	106.95 ± 0.74b	2.064 ± 0.017b
P3 (44-47)	62.59 ± 0.17c	53.02 ± 0.39bcd	111.90 ± 0.91c	2.112 ± 0.022c
P4 (48-51)	63.63 ± 0.18d	53.79 ± 0.46c	107.56 ± 0.14b	2.003 ± 0.018a
P5 (52-55)	64.48 ± 0.18e	52.43 ± 0.45bd	109.12 ± 0.08d	2.084 ± 0.018bc

*Period means within traits followed by different letters differ significantly ($P \leq 0.05$) from each other Duncan (1955)

(McNaughton, 1978; Weiss and Scott, 1979), whereas they disagree with those of Nakaue et al. (1980). This may be attributed to the best protein quality of rations containing a high rate of LDAM, thus making available the high rate of essential amino acids in addition to vitamin A; see North (1984). The high egg mass in T1 and C hen groups is attributed to high egg production rate in both groups T_1 and C, (85.34 %) and (85.48%) respectively compared to (83.05%), (83.27%) and (82.40%) for T2, T3 and T4. Age periods significantly affected egg weight as well as egg mass, the average egg weight increased gradually with the increase of birds' age and differences were significant between all age periods (Table 4). This is in agreement with (Cunningham et al., 1960; Nestor et al., 1972; Stadelman and Cotterill, 1995). Egg weight increased with age and is attributed to liver enlargement and consequently to increased yolk production and increasing yolk amount deposition in the egg. Egg mass improved with birds' age.

Feed intake in treatments were related to the high ration of the LDAM and consequently to a high level of fibre and saponin (Table 3), see (Donalson et al., 2005; Weiss and Scott, 1979). The birds' attempts to cover their needs for energy in view of the depression in the energy level in these rations and the presence of a reverse relation between the energy level in the feed and amount of feed intake is described by North (1984).

The decrease of feed conversion efficiency was observed along with the increase of birds' age (Table 4) in accordance with Scott *et al.* (1982).Treatments had significant ($P \leq 0.05$) effects on both feed intake and feed conversion efficiency (Table 3). Significant differences between C and T1 were observed compared with other treatments, a feed intake increase was associated with the increase of LDAM rate in rations, and conversely feed conversion efficiency was decreased. These results are in agreement to that of several other investigators (McNaughton, 1978; Weiss and Scott, 1979; Nakaue, 1980; Han and Parsons, 1990). There were significant differences between age periods in respect to both traits (Table-4). With the increase of birds' age feed intake was increased, whereas feed conversion efficiency decreased. The decrease of feed conversion efficiency was observed with the increase of birds' age, and this is in accordance with Scott *et al.* (1982). Birds of T1 and C excelled in the feed conversion efficiency in both the first and fourth age periods (P1 and P4), and this is attributable to the decrease of feed intake and increase of egg production percentage in P1 (84.52%) and an increase in egg weight in P4 (63.63g).

CONCLUSIONS

In a trial with six hundred Hy- Line®W-98 layer hens for 20 weeks, four levels (4, 8, 12 and 16%) of locally dehydrated alfalfa meals LDAM were used in the rations. The study was carried out to investigate the effects of LDAM and age on egg weight, egg mass, feed intake and feed conversion efficiency. The results are summarized as follows:

Non-significant effects of treatments were observed on egg weight, whereas treatments had significant ($P \leq 0.05$) effects on egg mass. Age had significant ($P \leq 0.05$) effects on both egg weight and mass. Egg weight increased when hens grew old. Treatments and age periods significantly ($P \leq 0.05$) affected feed intake (FI) and feed conversion efficiency (FCE). With increasing alfalfa meal levels in rations and birds' age, FI was increased, whereas FCE was decreased. The best replacement level of LDAM in layers ration for cereals was 4%, which causes the significant productive performance.

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