RESPONSE OF LAYING HENS TO DIETARY FULL-FAT SOYBEANS STEAMED FOR DIFFERENT TIME PERIODS

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ABSTRACT

Laying hens (56 weeks old) were fed for 8 weeks on diets containing 15.5% of full-fat soybeans steamed for 0, 5, 10, 15 or 20 minute. Average feed intake and egg production increased, with increase in length of time of steaming. Feed per dozen eggs decreased with increase in time of steaming dietary full-fat soybeans ($P < 0.05$). However, there was no significant effect of the dietary treatments on egg weight. Increasing the time of steaming dietary soybeans improved the retention of both protein and fat. It is concluded that steaming of soybeans did alleviate the problems associated with the feeding of raw soybeans.

Keywords: full-fat soybeans, timed steaming, laying hens

INTRODUCTION

There is increasing interest in the use of full-fat soybeans in poultry diets. This is to take advantage of the high protein and energy content of full-fat soybeans as opposed to the high protein, low energy found in soybean meal. Because of the presence of antinutritional factors (particularly trypsin inhibitor) in raw soybeans, effective use of full-fat soybeans in chicken diets depends on heat treatment (Hill and Renner 1963; Rogler and Carrick 1964; Moran et al., 1973). Existing methods for heating soybeans include autoclaving, micronizing, toasting and extrusion. Most of the current interest in the use of full-fat soybeans are generated by livestock producers who grow soybeans and want to use their on-farm product as an ingredient in livestock feed. Most of the heating method listed above involve the use of advanced technologies not usually available on the farm and certainly not in developing countries. There is hence the need for the development of simple, practical methods of heating soybeans which are adaptable to the on-farm situation. The present study was designed to observe the response of laying hens to diet treatments with the addition of soybeans steamed by a simple method for different time periods.

MATERIALS AND METHODS

Forty Hubbard hens of a commercial strain (56 weeks old) were used for this study. They were individually caged in an open sided house and fed the experimental diets shown in Table 1. The five experimental diets which were isonitrogenous (17% CP) and isoenergetic (11.3 MJME/kg) contained soybeans steamed for 0, 5, 10, 15 or 20 minutes. Steaming was undertaken in a double walled aluminium container using saw dust or firewood as the source of heat. Water at the base of the steaming device was allowed to boil, producing a temperature which usually stabilized at about 110°C in the tightly covered steaming chamber. A wire mesh basket containing the soybeans to be steamed was then placed in the steaming chamber, the container tightly covered and initiated. Although the steaming chamber had a capacity for 30kg, 15kg of soybeans were steamed at a time. At the end of the steaming period, the soybeans were removed and sun-dried prior to grinding and incorporation into the diets at 15.5% inclusion level.

Eight laying hens were randomly assigned to each diet. They were individually fed, thus each bird served as a replicate. Both the experimental diets and water were supplied *ad libitum* and natural day length was approximately 12h during the 8-week trial period. Birds were weighed at the beginning and end of the trial, and egg production was recorded throughout the trial. Feed consumption was measured on a weekly basis, while eggs were collected three times a week for weighing.

A nutrient retention study was undertaken with the same birds during the 4th week of the trial. Weighed quantities of feed were supplied and excreta samples were dried in a forced air oven at 70°C and ground prior to chemical analysis. Nitrogen in both feed and excreta samples was determined by the Kjeldahl procedure (A.O.A.C., 1980), while fat was determined by petroleum ether (Pb 40-60°C) extraction in a Soxhlet apparatus.

TABLE 1. INGREDIENT AND COMPOSITION OF EXPERIMENTAL DIETS (g/kg)¹

	Diets				
	1	2	3	4	5
Constant ingredients ²	845.0	845.0	845.0	845.0	845.0
Soybean (raw)	155.0	-	-	-	-
Soybean (5 min. steaming)	-	155.0	-	-	-
Soybean (10 min. steaming)	-	-	-	-	-
Soybean (15 min. steaming)	-	-	-	155.0	-
Soybean (20 min. steaming)	-	-	-	-	155.0
Analyzed nutrient content					
Dry matter	906.0	897.0	894.0	901.0	900.0
Crude protein	170.6	177.2	172.8	172.8	175.9
Crude fat	78.0	70.6	76.9	75.1	72.1
Crude fibre	84.9	44.8	44.3	46.7	48.6

¹ Calculated metabolizable energy for all diets 11.3 MJ/kg.

² Maize 460; wheat offals, 190; oyster shell, 75.0; bone meal, 20.0; vitamin concentrate, 100.0 (provided/kg of diet: 1.2g DL-methionine, 2.5g sodium chloride, 2.8mg retinol, 50ug cholecalciferol, 11mg DL - & - tocopheryl acetate, 2mg menadione, 7mg calcium pantothenate, 7mg riboflavin, 20 mg niacin, 8ug cyanocobalamin, 1.5mg folic acid, 0.3mg, 0.3mg biotin, 300mg choline chloride, 125mg ethoxyguin, 80mg manganese, 50mg zinc, 5mg copper, 25mg iron).

Data collected was subjected to a one way analysis of variance, using the completely randomized design (Steel and Torrie, 1980). Means of response variables having a significant F-test were further subjected to Duncan's multiple range test (Duncan, 1955).

RESULTS

Layer Performance

Table 2. shows the influence of dietary full-fat soybeans steamed for different time periods on bird performance. There was an increase in average daily feed intake and egg production with increase in the period of time of steaming ($P < .05$). Although all the birds used lost weight during the trial, weight loss by birds was inversely proportional to the length of time that the dietary soybeans were heat treated ($P < .05$). There was also a decrease in feed required per dozen eggs produced with increased time of steaming the dietary soybeans ($P < .05$). However, there was no significant effect of the soybean treatment on egg weight ($P > .05$).

Nutrient Retention

Although there was an improvement in the retention of both protein and fat, with increased time of steaming soybeans, these effects were not statistically significant ($P > .05$, $T_{\alpha\beta\lambda\epsilon} 3$).

DISCUSSION

Fisher *et al.*, (1957); and Saxena *et al.* (1963) reported that laying hens were insensitive to growth inhibiting properties of raw soybeans. The performance of birds fed the diet with raw soybeans in this study showed that dietary raw soybeans were detrimental to the performance of laying hens as indicated by the low feed intake, weight loss and low egg production. The present results seem to confirm earlier reports (Bornstein and Lipstein, 1963, Rogler and Carrick 1964; Moran *et al.*, 1973) showing the negative effects of raw dietary full-fat soybeans on performance of chickens.

TABLE 2. EFFECTS OF TIME OF STEAMING DIETARY FULL FAT SOYBEANS ON PERFORMANCE OF LAYING HENS OVER AND 8 - WEEK PERIOD

Time of steaming soybeans (min)	Daily Feed intake (g/hen) *	Body weight gain (g/hen/day) *	Hen Day Production (%) *	Feed per dozen eggs (kg) *	Mean egg weight (g) NS
0	85.3a	-4.2b	32.1a	3.91b	57.5
5	91.6b	-3.4ab	40.4ab	2.79a	58.7
10	90.3ab	-3.3ab	46.4bc	2.38a	57.2
15	96.4bc	-2.7ab	50.9c	2.35a	57.3
S.E.M.	3.43	0.67	5.35	0.29	0.49

Means within column followed by different letters are significantly different ($P < 0.05$).

Heat treatment is known to destroy the trypsin inhibitor present in raw soybeans (Mustakas *et al.*, 1946; Kouzeh-Hanani *et al.*, 1981; Beckric *et al.*, 1987). The present study showed that "steaming" of dietary soybeans did alleviate the problems associated with feeding raw soybeans. This is an indication that steaming is effective in destroying the anti-nutritional factors in raw soybeans. Thus feed intake, egg production, feed/dozen eggs and protein retention were improved with steaming of dietary soybeans. On the average, all the birds used in this trial lost weight during the trial, suggesting that egg production was accomplished to some extent at the expense of body reserves.

The effectiveness of steaming soybeans was directly related to the length of time for which the soybeans were exposed to the steam. Thus, feed intake and egg production were increased, and the feed was more efficiently utilized with increase in length of steaming from 0 to 2 minutes.

TABLE 3. EFFECTS OF TIME OF STEAMING DIETARY FULL-FAT SOYBEANS ON PROTEIN AND FAT RETENTION BY LAYING HENS (%)

Time of steaming (min)	Protein NS	Fat NS
0	38.3	67.88
5	41.8	68.05
10	45.8	65.2
15	52.6	76.64
20	50.2	75.63
SEM	2.58	3.00

NS No significant difference ($P > 0.05$).

The degree of body weight loss was reduced with increased time of steaming dietary soybeans. The result of the present study did not allow a statement on the optimum steaming time for soybeans. Further studies would be necessary in order to determine an additional advantage of heating soybeans beyond 20 minutes.

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